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# JOURNAL

OF THE

## INSTITUTE OF ACTUARIES.

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"I hold every man a debtor to his profession, from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavour themselves by way of amends to be a help and ornament thereunto."—Bacon.

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*On the Requirements of the Life Assurance Companies Act, 1870, in regard to Valuation Returns, with some Notes on the Classification and Valuation of Special Policies. By RALPH TODHUNTER, M.A., F.I.A., Assistant-Actuary of The National Mutual Life Assurance Society.*

[Read before the Institute, 24 April 1899.]

THE objects which I have set before myself in writing this paper are (1) to advocate a more elastic interpretation than has hitherto been usual, of the requirements of the Act of 1870 in regard to Valuation Returns; (2) to discuss some points that arise in the classification and valuation of Special Policies. The connection between these two objects consists in the fact that the necessity, or the supposed necessity, of conforming to the stereotyped schedules in which valuation returns under the Act are usually made, and the labour entailed by the individual valuation of special policies, constitute, jointly and severally, a serious obstacle to the rapid conduct of a life-office valuation. This may not be a matter of very great importance if or so long as a valuation is looked upon as a quinquennial or septennial event, for which special and extensive preparations must be made, and upon which months of overtime are to be spent, but it becomes a very different matter if a valuation is to be regarded—as it should, I think, be regarded, and as it undoubtedly is regarded in an increasing number of offices—as little more than an incident in the actuarial routine.

From the more modern point of view the periodical valuation falls into its place in a system designed, *inter alia*, to provide an independent check upon the office records, and to admit of a close watch being kept upon the progress of the business as a whole, and upon the working of the separate classes into which it may be divided for the apportionment of profits or for other purposes. It is unnecessary to recapitulate the advantages resulting from the adoption of a system of this nature, but I may direct special attention to the fact that, considered merely with reference to the quinquennial or septennial investigation, it possesses the very important advantages of minimising the labour and risk of error incidental to the valuation, and of leaving the actuarial staff comparatively free to deal expeditiously with the distribution of the surplus.

In offices where such a system is in operation, it is probably usual to have a valuation of the entire business, or, at any rate, of the more important classes at the end of each year; even if this is considered unnecessary, it is certainly most useful to have a complete valuation a year before the close of the inter-valuation period. It is therefore essential that the Valuation Register, or Classification, should be in such a form as to admit of a valuation being made, and of the financial position of each class being ascertained, in a minimum of time with a minimum of labour. For the purposes of ensuring the accuracy of the valuation particulars, and of obtaining an independent check upon the office records, it is also essential that the methods of classification should have some relation to the general statistical organization of the business, that the classification and the office records should, in fact, be mutually complementary.

To these requirements it would probably be usual to add the following:—(1) that the classification should admit of an analysis of the surplus; (2) that it should be adapted to meet the requirements of the Act of 1870. The first of these conditions does not necessarily impose any restrictions upon the methods of classification and valuation, for the surplus in each class, when ascertained, can be analysed (with sufficient completeness, in my opinion, for any practical purpose for which an analysis is likely to be wanted) by the “prospective and retrospective” method. I therefore dismiss this condition as irrelevant to my immediate purpose. In passing, however, I venture to suggest that an undue amount of importance has been attached to the determination of the profit or loss on

mortality. Apart from its bearing upon the accumulation of surplus, the mortality-experience in the course of a year or even a quinquennium is of little practical importance, and when the surplus has been ascertained by direct valuation, the profit or loss on mortality becomes almost entirely a matter of academic interest. For the purpose of making a reserve for "suspended mortality" it may be desirable to ascertain the apparent profit from vitality on recently selected business, or for the purpose of testing the efficacy of the selection it may be necessary to investigate the mortality among recent entrants, but neither of these objects has anything in common with a comparison of the actual and expected death strain. Yet the practice of investigating the annual profit or loss on mortality has acquired such an adventitious importance, owing to the fact of its having been very generally employed, and of course properly employed, in offices where interim valuations have not been customary, for the purpose of forming an idea of the growth of the surplus during an inter-valuation period, that certain misconceptions seem to have arisen as to the object of such an investigation and the meaning of its results. Quite recently, an office which has been making annual valuations for some years past, declaring a substantial annual bonus and steadily increasing its undivided surplus, was taken to task in a journal of high standing for not having published any particulars of its actual and expected mortality for the previous year, while in another instance, an appreciative article on an excellent valuation report concluded with a criticism apparently intended to convey the view that the results of the valuation would have been far more satisfactory if the amount of the profit on mortality had been stated. Neither the expected and actual claim-experience in the one case, nor the profit on mortality in the other, would have had any bearing upon the situation, or have conveyed, so far as I can see, any useful information to the managements of the two offices or to the public.

#### THE REQUIREMENTS OF THE ACT OF 1870.

I pass on to the question of the adaptation of the methods of classification to the requirements of the Act of 1870. From the simple proposition that any method of classification, if it is to be entirely satisfactory, must be adapted to meet statutory requirements there can of course be no dissent. But the acceptance of this proposition appears to me to be consistent with a very



different interpretation of the requirements of the Act of 1870 from that which has been generally accepted; in view of Section 9 of the Act, it does not seem in any way incumbent upon life offices to accept a supposed obligation to conform to the requirements of the 5th and 6th schedules to the Act, as if these schedules were as unalterable as the laws of the Medes and Persians. This in itself would be a point of no practical interest if the usual interpretation of the requirements of the Act were generally acceptable as well as generally accepted. But that is certainly not the case. To mention one point only, the requisition as to the total amount of premiums received from the commencement under special policies is, by common consent, a most objectionable feature. Mr. King refers to it in his paper on Legislation affecting Life Assurance Companies in the following terms:—“Heading No. 6, which asks for the total amount of premiums “which has been received, is perhaps that which produces the “most irritation among the companies’ officials. The information “is very troublesome to extract, and is of little use.” The concluding sentence of this quotation (with slight verbal alterations) may, in my opinion, be applied with equal appropriateness to the value of the office yearly premiums, which is supposed to be called for (although as to the strict accuracy of this view, even upon the most literal interpretation of the schedule, there appears, as I have explained later on, to be some doubt) by the 7th question in schedule 5. Bearing in mind the opinion expressed by Mr. Bailey, in the discussion on Mr. King’s paper, that “the present value of the gross premiums payable should “be required”, and his expression of astonishment that “an “estimate of the liability under a policy should sometimes be “made, taking no account whatever of the actual premiums “payable”, I feel some diffidence in expressing a contrary view. It does, however, appear to me that in the case of an office which makes a net premium reserve the valuation of the office premiums is absolutely useless. In such a case, the value of the office premiums does not enter into the calculation of the net liability, and it certainly cannot be regarded as a good asset, unless it may be in the exceptional case of an old series which has been closed for a period sufficient to admit of negative values having run off. The reserved loading *per annum*, which is readily obtainable from the particulars of the office and net yearly premiums given in the summary, is, of course, an important factor, but its *capitalized value* serves, so far as I know, no purpose except that of



conveying nothing to the mind of the public in valuation reports and prospectuses, and, if it should be required, it can be obtained with quite sufficient accuracy by a simple proportion sum. On referring to the valuation reports of two large offices, selected at random, I find that in one the values of the office and net yearly premiums are respectively 12·89 and 12·88 times their annual amounts, while in the other the figures are 11·64 and 11·58 respectively, so that in either case the value of the office premiums could have been determined with approximate accuracy by multiplying the annual amount of the office premiums by the ratio of the value of the net premiums to their annual amount. It may be considered that the valuation of the office premiums affords a useful check upon the accuracy of the valuation of the net premiums; the utility of the check obtained in this way is, however, very doubtful, seeing that the use of an incorrect annuity-value in performing the multiplications would produce corresponding errors in the values of both the office and the net premiums.

But the case against the orthodox interpretation of the requirements of the Act rests upon arguments very much stronger, to my mind, than any that can be based upon the uselessness of the “total premiums received”, and the “value of the office yearly premiums.” The calculation of these two functions merely involves so much waste of time and labour, and, possibly, the addition of a couple of extra columns to the classification and valuation sheets. Far more serious objections to the customary interpretation of the requirements of the Act are the facts that it constitutes an obstacle to the adaptation of the classification to the important purpose of enabling a valuation to be expeditiously made, that it practically restricts offices to a stereotyped method of classification and valuation, and that it operates as a continual restraint upon progress and improvement in this important branch of actuarial work. In support of this indictment, I may point out that to conform strictly to schedules 5 and 6 as they stand, it is generally considered necessary

- (1) To exhibit the net liability as the difference between the value of the sums assured and bonuses, and the value of the net premiums;
- (2) To make separate valuations in respect of assurances for the whole term of life, and assurances of other descriptions.

The first of these conditions practically precludes life offices from adopting any other method of valuation than that symbolically represented by the formula,  ${}_nV_x = A_{x+n} - P_x \cdot a_{x+n}$ . There are, however, other methods of valuation which it should, in my opinion, be open to life offices to adopt; among them I may mention the following:

(1) *The method represented by the formula*

$${}_nV_x = 1 - (P_x + d) a_{x+n}.$$

The use of this method would entail no additional trouble in classification, and would reduce the labour of actual valuation by one-half. The formula given above would, of course, have to be modified to suit the conditions of practice. One way of applying it would be to multiply the  $\Sigma \cdot S(P+d)$  at each age by the appropriate value of  $(\frac{1}{2} + a)$ , and adjust the aggregate for all ages by adding  $\frac{1}{2}d \cdot \Sigma S$ . A better plan would perhaps be to tabulate  $({}^\infty P + \delta)$  and value by the formula  $1 - ({}^\infty P + \delta) \bar{a}_x$ , which would have the effect of including in the reserve full provision for immediate payment of claims. In either case, the necessary adjustment, if any, for the unequal incidence of the premium income, could be made by adding a proportion of the office annual premiums or the estimated net premiums. The application of the method to endowment assurances would present some difficulty, inasmuch as the valuation of endowment assurances, subject to  $t$  remaining years' premiums and maturing on the anniversary, by the formula  $1 - ({}^\infty P + \delta) \bar{a}_{x:\overline{t}|}$  would have the effect of antedating the maturing of the endowment by half-a-year on the average, but the difficulty might be met by an average adjustment, similar, but opposite in sign, to that which is frequently made to provide for immediate payment in case of death. In this connection, I may notice that in an ordinary valuation, when the sums assured are assumed to mature on the average  $t + \frac{1}{2}$  years after the date of valuation, and  $t$  full years' premiums are payable, the reserve for early payment may be implicitly made by the use of the formula  $(1 + \frac{i}{2}) A_{x:\overline{t+1}|} - P(\frac{1}{2} + a_{x:\overline{t+\frac{1}{2}}|})$ ,  $x$  being the valuation age—that is, by valuing the sums assured by  $A_{x:\overline{t+1}|}$ , instead of the usual  $A_{x:\overline{t+\frac{1}{2}}|}$ , and adding to the net liability half-a-year's interest on the aggregate value of the sums assured. By this formula the same reserve of loading is made as in the case of a valuation without allowance for early payment of claims.

According to the strict theory of net premium valuation, the adjustment should be applied to the net premium, as well as the value of the sum assured—with a consequent reduction in the reserved loading—and if it were considered desirable, this could be effected by scheduling the net premium  ${}^{\infty}P$  instead of  $P$ . In practice, it is probably not unusual to schedule endowment assurances maturing on the birthday as if they matured on the anniversary, so that the valuation provides for the payment of the endowment two or three months, on the average, before it is actually due—or, perhaps, rather more when allowance is made for the unavoidable delay that occurs, in some cases, in the payment of the endowment. In these circumstances, it is a question whether any additional reserve for early payment is necessary.

(2) *The method of valuing by prepared tables of policy-values.*—This method can be adapted to a classification according to the year or month of entry, and the policy-values might be scheduled in advance for a series of years. Having regard to the prevalence of the method in the States, and to the remarkable celerity with which the valuations of the American and Canadian companies are conducted, I think that it deserves more consideration than it has hitherto received in this country. One obvious advantage that it has over the other methods to which I have referred, is that every group of policies, except those for the year or shorter period preceding the date of valuation, is closed to new business, so that the bulk of the valuation work can be done in advance, subject only to the deduction of the scheduled values of cancelled policies. I have not had an opportunity of ascertaining exactly how the method is applied in practice, but I find it stated in the returns made to the Board of Trade by one of the largest American companies, that the office-valuation had been made by groups (from which I infer that similar policies issued in the same month or other period were valued in a single group), while in the check-valuation by the New York Insurance Department, each policy had been valued separately; the results brought out by the office and the Department in this case differed by less than .1 per-cent of the total net liability. The method necessitates the preparation of very extensive tables of policy-values, and it becomes rather complicated when applied to special policies. Thus, in a paper read before the Actuarial Society of America by Mr. A. K. Blackadar, on “Formulas for the Direct Application of Interpolated Values of well-known Policies to the Valuation of

“ Limited Payment, Changed, and Lien Policies”, the value after  $\left(s+n+\frac{t}{12}\right)$  years of an ordinary life policy taken out at age  $x$  and changed at the end of  $s$  years into an  $m$ -year endowment assurance is expressed in the form  $v_t - (1 - {}_sV_x)(v_t - {}_{n+\frac{t}{12}}V_{x+s.\overline{m}})$  where  $v_t$  is the interpolated value at the end of  $t$  months between 1 at the beginning of the year and  $v$  at the end of the year. Of course, a policy of this description is much more simply dealt with by scheduling it with an appropriately modified net premium in the class to which it has been transferred.

(3) *The accumulation method described by Mr. Searle in his paper on the Progress of Profit in a Life Assurance Fund, and represented by the formula*

$$(1+i)({}_nV + P) - \frac{q}{p} \left\{ 1 - (1+i)({}_nV + P) \right\}.$$

This method has, in my opinion, many recommendations. It exhibits the constituent elements of the liability in a simple and business-like way, and it has the advantage of admitting of the valuation in a single group of all policies on single lives of the same attained age, under which the sums assured are payable in the event of death, while even pure endowments could be included, provided they were scheduled in a separate column, so that the product of the total endowments and the mortality-multipliers could be added to the accumulated liability. The chief objections that have been advanced to the use of the method—leaving out of account the fact that it does not afford an analysed valuation in the form required by the fifth schedule, which is not, for the purposes of my argument, an admissible objection—are (a) that it necessitates a large amount of skilled labour; (b) that it would accumulate an error.

With regard to the first of these objections, it is a question whether the mere fact of a method of classification or valuation requiring a certain amount of skill in its application is a valid argument against that method. Personally I do not believe in the employment of “a clerk of average intelligence without any actuarial knowledge” upon the actuarial classification, any more than I should believe in the employment of a clerk without any knowledge of the principles of book-keeping upon the ledger, nor is there any such dearth of actuarial clerks as to render it necessary that the possibility of a valuation method being applied by a non-actuarial clerk should be regarded as a necessary test of

its merits. As regards the *amount* of work involved, it appears very probable that practical experience of the method under consideration would suggest simplifications. Many of the complications that arise in the application of the method are due to the element of new business, and these might be, to some extent, eliminated by allowing new business to remain on probation for a year (in accordance with a plan I have suggested later on) before transferring it to the permanent classification.

Practical experience, moreover, while suggesting simplifications, would possibly devise checks which would meet the second of the objections mentioned above. If, however, a periodical check were found to be necessary, it would not be impossible to apply it by inserting the individual policy-values (taken from prepared tables according with the basis of valuation) in columns reserved for the purpose; errors would be readily detected, as the accumulated values and the totals of the individual values would have to agree for each valuation year of birth. I have already referred to the rapidity with which check valuations of a similar character appear to be conducted by the American Insurance Departments.

I have not attempted, in the foregoing paragraphs, to give a complete *résumé* of the various methods which might be employed in life-office valuations, nor is it my object to maintain the superiority of any one of the three methods which I have briefly described to the method which is generally employed by British offices. I have simply endeavoured to show that there are alternatives to the usual method which might be better adapted to the requirements of modern life assurance business, and which it ought to be open to life offices to adopt. It is, of course, impossible to form an adequate opinion upon the relative merits of different valuation methods so long as the restrictions imposed by a narrow interpretation of the Act of 1870 operate as a bar to investigation and practical experiment, but I think that a sufficiently good *a priori* case can be made out for each of the methods I have mentioned, and probably for others which I have not mentioned, to justify the view that the restrictions which prevent us from giving them a fair trial ought to be removed.

So far, I have referred more particularly to the first of the conditions mentioned on page 5, namely, the necessity of exhibiting the net liability as the difference between the value of the sums assured and bonuses and the value of the net premiums. The second condition—the necessity of making



separate valuations for whole-life assurances and assurances of other descriptions—may be dismissed more briefly. Practically, the only restriction which it imposes is a restriction upon the classification of endowment assurance policies and other policies involving the endowment element with whole-life policies, and, as many actuaries would probably prefer, on other grounds, to classify endowment assurances separately, this is not a very serious matter. At the same time, any restriction of this nature appears open to objection. In offices in which all with-profit assurances are placed upon the same footing as regards bonus—whether the contribution method or the uniform reversionary or cash bonus method of allocation be adopted—and in all offices, so far as their non-participating policies are concerned, there does not appear to be any special reason for the separate classification of endowment assurances, and it ought to be permissible, if it were found convenient, to classify them with whole-life assurances for valuation either by the accumulation method or by the method described by Mr. Whiting and Herr Altenburger—an extra column being added to the classification, in the latter case, for scheduling the endowment factors. Of course, this method of treatment would render it impracticable to ascertain and analyse separately the profits on endowment assurance and whole-life business, but this does not appear to me a practical objection, provided the profits on the two classes are pooled for the purpose of allocating bonuses. Apart from any bearing it may have upon the distribution of surplus, the separate determination or analysis of the profits arising from different classes of assurances (as distinguished from different sections of the business for which separate funds have to be kept) does not seem to be of much importance. The question whether the profits *ought* to be pooled is one to be determined by an investigation of the mortality experience under the different classes of policies and by reference to the way in which the premiums are loaded.

In addition to the two conditions mentioned on page 5, there is a third which I have felt some diffidence in formally including among the restrictions to which I take exception. I refer to the necessity, for the purpose of conforming to the schedules, of classifying with-profit and without-profit assurances separately. The separation of these two great classes has been such a fundamental principle in my official experience that I am not sure what their amalgamation might involve. But, so far as I

can judge, there seems no special reason for keeping them separate in offices where the profit or loss on the non-participating business has not to be apportioned among different sections of participating policyholders or brought into account in a distribution by the contribution method. For convenience in trial-bonus estimates, it might be desirable to schedule the non-profit sums assured in a separate column, but this, of course, would be merely a practical detail.

I have now stated what appear to me to be the most serious objections to the usual interpretation of the requirements of the Act of 1870, and I have also referred incidentally to the section of the Act which admits of the modification of the existing schedules. Before proceeding to state what I conceive to be the interpretation of the Act at which life offices should aim, I will give a few particulars of the modifications of the schedules which have been accepted by the Board of Trade in the returns of certain companies in the course of the last few years.

*Fifth Schedule. Heading No. 7.*—In filling up the form referred to in this question, it is a usual practice to exhibit “assurances for the whole term of life” in several sub-divisions—whole life assurances subject to uniform premiums payable throughout life, whole-life assurances subject to limited premiums, paid-up assurances, whole-life assurances subject to increasing premiums, etc. This practice is unobjectionable, provided it is not considered to be obligatory (as Mr. King, in his paper on Legislation affecting Life Assurance Companies, proposed that it should be made) upon all offices, whether it accords with their methods of valuation or not, but it certainly seems inconsistent with the literal conformity which is rendered to the other requirements of the schedules.

In the “Valuation” side of the form, one British company and four foreign companies have returned the “net liability” only, without giving the separate values of sums assured and bonuses and net premiums; a second British company has adopted a similar course in respect of its ordinary whole-life business, and a third in respect of its special policies.

Five companies, in addition to those referred to in the last paragraph, have returned the values of the office yearly premiums as “not computed.”

In an earlier part of this paper I have expressed some doubt as to whether, even upon a strict interpretation of the existing schedules, it is necessary to return the values of the office yearly



premiums. The question calls for "the liabilities of the company under life policies and annuities at the date of valuation, showing the number of policies, the amount assured, and the amount of premiums payable annually under each class of policies, both with and without participation in profits; and also the net liabilities and assets of the company with the amount of surplus or deficiency", and it states that "these returns should be made in the form annexed", but it does not state that all the columns provided in this form must be filled up, nor that the additional particulars referred to in the headings of the form must be supplied; that requirement, if it is one, is merely an inference from the fact that two of the headings are limited by the words "if ascertained" and "if computed." The point is not of very much importance from my point of view, inasmuch as I base my contention upon the much broader ground of the discretion given to the Board of Trade by Section 9 of the Act, but it may account for the latitude observed in regard to the values of the office yearly premiums by offices which have rigorously calculated the "total premiums received."

*Sixth Schedule. Heading No. 3.*—In answer to this question, one company has divided the "premiums receivable in respect of the respective assurances mentioned under heading No. 2", into premiums receivable throughout life and premiums "terminable." From internal evidence, I infer that the classification of this office contained the net premiums and loadings (the office premiums being obtained, according to the plan recommended by Mr. C. D. Higham, by adding the loadings to the net premiums), that the sums assured under whole-life policies subject to limited premiums and the corresponding whole-life loadings were classified with the ordinary whole-life policies, and that the office limited premiums were separately classified. Possibly, in this case, the limited premiums were valued individually; if they were classified according to term, a re-classification would be necessary in order to exhibit them as "terminable" premiums at the attained ages, and conformity to the schedule would be gained at the cost of some trouble and by the sacrifice of the very object which the schedule is intended to serve. As they are returned in the case in question—without particulars of the term to run—they are, of course, useless.

*Sixth Schedule. Headings Nos. 4 and 5.*—These questions call for certain particulars in regard to "classes of assurance business other than for the whole term of life." They are

usually interpreted as applying to assurances other than whole-life assurances subject to uniform future premiums (or sometimes uniform premiums throughout) payable for the whole of life, in accordance with the limited construction placed upon the words "for the whole term of life" in headings No. 7 of the fifth schedule and Nos. 2 and 3 of the sixth, and, subject to the proviso which I have stated in referring to question 7 of the fifth schedule, this interpretation does not appear to be in any way open to objection.

*Sixth Schedule. Heading No. 6.*—Under this heading the companies are required to return the "total amount of premiums received from the commencement" upon all policies except whole-life policies. This information is generally admitted to be practically useless for the purpose for which it is required. In the case of increasing-premium and term assurances, for example, the reserve has no relation to the premiums received, while in the case of endowment assurances—the most important class—the relation is so distant that I find, on referring to the returns of two companies transacting a large volume of this class of business and valuing on the same basis, that in one instance the reserve is less than 60 per-cent of the premiums received, while in the other it is more than 80 per-cent. Yet the companies, almost without exception, have conformed to this requirement. One company has returned a schedule of its endowment assurances, classified according to maturing ages, and sub-classified according to valuation-ages, and a schedule of joint-life assurances, classified according to the sum of the two ages; one other company has returned a schedule (the classification being according to maturing years, and an average valuation-age for each group being given) for whole-term assurances converted into endowment assurances by application of bonus. In these two instances the total premiums received are not returned, and they are, so far as I am aware, the only exceptions to the rule.

*Sixth Schedule. Headings Nos. 7 and 8.*—One foreign company has returned a complete schedule, by ages, of its joint-life annuities. This seems to be in accordance with a strict interpretation of the requirements of heading No. 7, but it is not usual.

This is, I believe, a practically complete list of such modifications of the requirements of the fifth and sixth schedules (so far as they affect the questions of classification and valuation) as are

shown by the valuation returns deposited with the Board of Trade in the five years 1893-97. Subject to anything that may be disclosed by the returns deposited last year (which are not yet published), it shows that, with very few exceptions, British life offices have conformed strictly to what I have described as the orthodox interpretation of the requirements of the schedules. The few exceptions prove—if it could be supposed to require proof—that there is no indisposition on the part of the Board of Trade to accept reasonable modifications, and the general observance of the rule may therefore be held to show that British life offices generally have made no attempt to interpret the Act in a sense which would accord with modern methods of classification and valuation. They have adopted in practice the principle inferentially laid down by Mr. Chatham in his condemnation of a particular method of classification on the ground that it did not meet the requirements of the fifth and sixth schedules, and they have continued to return, at the cost of considerable labour, information which is recognized by almost every actuary to be absolutely useless.

This course of action seems to me neither dignified nor convenient. If it had been the intention of the Legislature that companies transacting life assurance business in the United Kingdom should be required to conform to a stereotyped method of valuation, or if the modification of the existing schedules entailed the necessity for further legislation, there might be good reason for accepting the situation. But, as a matter of fact, neither of these conditions obtains. Is there any ground for the view that Parliament has intended to dictate to life offices a particular method of valuation or classification? I need hardly say that there is not. Such an intention would have been opposed to the entire spirit of life assurance legislation in this country, to that principle of freedom which Mr. King eloquently enunciated in his paper on Legislation affecting Life Assurance Companies, but to which, I venture to think, he hardly did justice in advocating, in the interests of that other cardinal principle of publicity, amendments of the schedules which would render them still more of a strait waistcoat than they are at present.

So far from having intended to impose a rigid system upon life assurance companies, without regard to their convenience, Parliament is believed to have accepted the fifth and sixth schedules, without alteration, from the pen of a practical life assurance man—the late Mr. Pattison. This fact, taken in conjunction

with the clause in the Act providing that “the Board of Trade, “ upon the application of, or with the consent of, a company, may “ alter the forms contained in the schedules to this Act, for the “ purpose of adapting them to the circumstances of such company, “ or better carrying into effect the objects of this Act”, points to the conclusion that Parliament adopted the present schedules on the supposition that they were adapted to the circumstances of life assurance companies in 1870, and with the intention that they should admit of modification as the circumstances of life assurance business changed. In this connection, I may point out that the phrase, “the forms contained in the schedules to this Act”, does not apply solely to the forms referred to under certain headings in Schedule 5. It may, apparently, be construed as though it read, “the schedules to this Act.” This follows from the sense in which the expressions “the form prescribed in the fifth schedule to this Act” and “the form contained in the sixth schedule to this Act” are employed in Sections 7 and 8, and from the action of the Board of Trade in accepting certain modifications of the sixth schedule.

It appears clear, then, that no serious obstacle exists to a more elastic interpretation of the requirements of the Act of 1870 than is at present usual, and it only remains to state the principles upon which, in my opinion, that interpretation should proceed. These principles are simply:

- (1) That the method of classification and valuation should determine the form of the returns under the Act, instead of being determined by the schedules to the Act;
- (2) That there should be absolute freedom as to the method of valuation to be adopted, subject (*a*) to its being adequately described in the answer to question No. 2 of the fifth schedule, (*b*) to such particulars being given in answer to questions Nos. 2–8 of the sixth schedule as would admit of a rough check valuation of the principal classes of assurance being made by an outside expert. These particulars would merely be an abstract of the actual particulars employed in the valuation.

The Act does not preclude the acceptance of these principles, nor, I venture to think, would the Board of Trade, acting under the competent actuarial advice which it has at its command, hesitate to

exercise its discretionary powers to sanction in each case such alterations of the schedules as would admit of the interpretation of the requirements of the Act in accordance with these principles. What is wanted is a recognition of the fact that a form designed 30 years ago is not necessarily adapted to present day requirements. An expression of opinion to this effect by this Institute would carry great weight, and such an expression of opinion I earnestly hope that this paper may elicit. An incidental advantage, which might be expected to result from the general adoption of such an interpretation of the Act as I have suggested, would be the earlier publication of the valuation returns. The companies would have much less trouble in preparing the abstract and statement required by Sections 7 and 8 of the Act, and would, consequently, be able to return them earlier in the year. At present the returns made to the Board of Trade in respect of a valuation as at 31 December are not published in a Blue Book until nearly 18 months later. This cannot be said to compare favourably with the practice of Insurance Departments in the United States.

#### VALUATION OF SPECIAL POLICIES.

I propose to conclude this paper by discussing a few points that I have had occasion to investigate in regard to the classification and valuation of special policies. From what has gone before, it will be seen that this subject is closely connected with the question of the interpretation of the requirements of the Act of 1870, inasmuch as the usual interpretation of the Act precludes, to a very great extent, a free handling of special policies. In the remarks that I have to make, I shall assume that the Act, properly interpreted, imposes no restrictions upon methods of classification and valuation.

The principles to be observed in adapting a classification to an expeditious and accurate valuation are, in my view, (1) that the classification should exhibit the particulars for valuation in such a form that no questions of principle or method are left to be decided when the actual moment for valuation arrives, and that the actual work of valuation is confined to the necessary arithmetical calculations; (2) that, in accordance with this principle, the special features of special policies should be dealt with at the outset, and that all such policies should be relegated, as far as possible, to the large schedules. In my experience it is not



the great mass of the policies, but the specials and the questions that arise in connection with the bonuses on re-assurances and similar matters, that cause most trouble in life-office valuations, and I cannot but think that the attempt to deal with these questions under pressure entails a very considerable liability to error. I have heard of an instance in which a state of panic existed for several days in a leading life office at the most critical stage of the periodical investigation, in consequence of an apparent deficiency brought out by the erroneous treatment of re-assurances under the stress of an *ab initio* valuation; a methodical system of classification precludes the possibility of unpleasant incidents of this nature. There is a certain amount of work that cannot very well be done until the last moment—that is to say, until the office new business and cancelment-books have been definitely closed—but it seems to me that the special work of a valuation (apart from the actual calculations) should be strictly limited to work of this nature. In offices where the business is divided into two classes only (a with-profit class and a without-profit class), and where there are few special policies, the question is not, of course, of so much importance, but I doubt whether there are very many offices with a constitution of so simple a character. In my own experience I have had to do with a business in which there were seven separate whole-life sections (without counting re-assurances) and four endowment assurance sections (including in that category a section of whole-life assurances converted into endowment assurances by application of bonus), in each of which it was necessary that the net liability should be separately determined; in such a case the desirability of preliminary legislation upon all special questions is obvious. It may be of interest to state that by means of a classification designed upon the principles I have mentioned, and of a preliminary valuation of the irreducible minimum of specials, it was found practicable, in the case of the business in question, to complete a valuation within six days after the office books had been closed.

Before passing on to questions relating to special policies, I should like to refer briefly to two points which can hardly be said to come in that category, but which are not unconnected with the subject under consideration. The first has reference to the method of dealing with new business. A plan which might, I think, be found useful in dealing with new business, and which I have referred to incidentally in an earlier

paragraph, is to postpone the writing-up of new policies in the permanent classification until the year after the year of issue (very much in the way that Mr. Rea deals with industrial policies), and to value them at the end of the year of issue by reserving one-half or two-thirds of the year's new annual premiums plus the whole of the new single premiums. New policies usually come on the books with a rush towards the end of the year (especially in the "bonus" year)—that is to say, at a time when it is least convenient to write them up in the classification—and the suggested plan would admit of the entire classification work of each year being done at a less busy time. The plan appears to me unobjectionable in principle, and it might, I think, be found convenient in offices where the actuarial staff is small and where the pressure of business towards the close of the year is severe.

The other point relates to the employment of the methods of valuation described by Mr. W. D. Whiting in a paper read before the Actuarial Society of America in October 1894, and by Herr Altenburger in a letter published last July in the *Journal of the Institute*. This method, as applied to a valuation in which the premiums are assumed to fall due, and endowments to mature, on the anniversaries of the dates of commencement in the middle of the year, gives the following formulas for the values of limited payment whole-life assurances, endowment assurances, and double-endowment assurances:—

For whole-life assurances subject to limited payments :

$$A_x - (P' - \phi)(\frac{1}{2} + a_x) + \frac{P' \cdot N_{x+n-\frac{1}{2}}}{D_x}$$

where  $P'$  is the office premium,  $\phi$  the whole-life loading,  $n$  the number of premiums payable, and  $x$  the valuation age.

For endowment assurances :

$$A_x - P(\frac{1}{2} + a_x) + \frac{N_{x+n-\frac{1}{2}}(P + d)}{D_x}$$

For double-endowment assurances :

$$A_x - P(\frac{1}{2} + a_x) + \frac{N_{x+n-\frac{1}{2}}(P + d) + D_{x+n+\frac{1}{2}}}{D_x}$$

where in the last two formulas  $P$  is the net premium and the suffixes have the same meaning as in the first formula. The age  $x + n$  is, of course, independent of the valuation-age.



I have not had an opportunity of investigating the practical working of these formulas, and have given them with the intention rather of not leaving so important a method unnoticed in the first paper dealing with questions of valuation which has been read before the Institute since the method was brought prominently before the members in the *Journal*, and of affording an opportunity for its discussion, than of dealing with it myself. At the same time, I would express, with some diffidence, a doubt whether the method, although very attractive on account of its accuracy and of the fact that it admits of the classification of endowment assurances, if desired, with whole-life assurances, is really of practical value. Personally, I feel very strongly the force of the arguments which the President has more than once advanced in favour of classifying endowment assurances by a method showing the amounts maturing for payment year by year, but it is not so much on this ground as on the ground of liability to error that I am disinclined to adopt the method. The one great danger in every system of continuous classification is the risk of an error making its way into the statistics and remaining undiscovered. That this is a very real danger may be shown by the fact that in a continuous classification which I had occasion to examine some time ago, numerous errors were discovered—policies remaining in the classification that had been cancelled 15 or 20 years before, net premiums incorrectly taken off or left on, mistakes in casts, &c.—but it is a danger which can be effectually guarded against, for all the ordinary valuation quantities, by agreement with independent office records. The net premium total is the only one in a modern classification which is liable to go astray, but its accuracy can be practically secured by having the premiums posted from a book recording them in numerical order, and affording a total which can be used for an agreement at the end of the year, and by having the cancelled premiums written up in classification order in a classification cancelment book, and checked on the face of the classification as the cancelments are taken off each group at the end of the year. Further, the totals of the office premiums and the net premiums for successive years afford a comparison by inspection which operates as a supplementary check, and would at any rate prevent any serious error. Could an equally satisfactory check be applied to the collection of functions

$$N_{x+n-\frac{1}{2}}(P+d), N_{x+n-\frac{1}{2}} P', N_{x+n-\frac{1}{2}}(P+d) + D_{x+n+\frac{1}{2}}$$

especially if they were all scheduled in one column of the whole-life classification? If some of these quantities were entered at ten times or one-tenth of their correct values, would there be anything on the face of the classification (as there is in the case of net premiums) which would be likely to draw attention to the error? Similar objections may be held to apply to the use of Mr. Lidstone's  $Z$ , but they do not appear to apply with anything like the same force, for the function ultimately obtained by means of  $Z$  is an *age*, and it would be impossible for this age to go far astray without attracting attention.\* In this connection I may be permitted to fully endorse all that Mr. Lidstone has said as to the facility with which  $Z$  can be used. In my own experience two large classes of endowment-assurances were valued by means of  $Z$ , within two or three weeks after the reading of Mr. Lidstone's paper, and the subsequent scheduling of the function for new policies has been found a very simple matter.

I proceed to consider questions arising in connection with a few special policies.

(1) *Policies for the whole term of life subject to uniform future premiums.*—All policies of this description, subject to premiums payable throughout life (including those under which no premium is payable, increasing premium policies in their second stage, and policies altered to whole-life policies), can of course be scheduled together. The only point that arises is in regard to the net premium, which has to be calculated with reference to the particular circumstances of the case when the policy is written up. In the case of non-profit specials and of all with-profit specials taking the same bonus as ordinary policies effected at the same age, a convenient plan is to reserve the same loading as would be reserved in respect of the corresponding ordinary policy; the net premium in these cases will then be appropriately determined (subject to the revision of any premium which would give a negative value) by deducting the ordinary loading from the actual premium payable. In the case of a paid-up policy the net premium will be a negative quantity, which will be written up in red ink, with a minus sign before it, and deducted in the cast. These negative quantities give no trouble in addition, provided they are in a minority.

\* If the endowment assurances (to take one example) were *separately* scheduled, it would be possible to *deduce* an average maturing age by dividing the  $\sum .N_{x+n-\frac{1}{2}}|(P+d)$  by  $\sum .(P+d)$ , but the age would not appear on the valuation-sheets, in the actual process of valuation, as it does in the application of  $Z$ .

*Limited Payment Policies.*—The method of dealing with these policies by including the sums assured, bonuses, and loadings in the whole-life schedule, and valuing the office premiums separately, has been employed by at least one office, as I have already had occasion to state, and has been fully described by Mr. Chatham in the last Messenger Prize Essay. The only particular in which the plan I should use may differ from that adopted by the office in question, would be that I should schedule the loading as a negative net premium, and value net premiums only, whereas in previous applications of the method, it may have been usual to schedule the loadings, and value office premiums and loadings—a method which doubles the work.

A point arises, however, as to the valuation of the office limited premiums. Mr. Lidstone's Z is admirably adapted to this purpose, and as only premiums are in question (and not, as in the case of endowment assurances, sums assured, bonuses, and premiums), there can, of course, be no possible doubt as to the accuracy of the method. A small collection of 145 limited premiums was valued by this method last January, and for the purposes of this note, I recently had an individual valuation made. The result brought out small differences in about one-half the groups (the seriatim and group values agreeing in the other cases), and a net difference of £7 on a total value of between £22,000 and £23,000.

It has been suggested that limited premiums should be classified with endowment assurances, but this method of treatment would not be satisfactory unless separate calculations were made for the average valuation-age for sums assured and premiums.

I may point out in this connection, that commuted extras, and temporary bonus reductions of premium may be conveniently dealt with by a method similar to those adopted for limited premiums—with which they would, of course, be scheduled.

*Whole-Life Assurances subject to increasing premiums (First Stage).*—Mr. Chatham proposes to deal with assurances of this description by making the same reserve as for short-term policies, plus the excess of the premiums received over the premiums that would have been received upon corresponding short-term policies. This method appears simple and satisfactory, but one which is, I think, even simpler and equally satisfactory is to reserve a gradually increasing proportion of the low premium. The reserves required on the transfer of these policies to the ordinary whole-life schedule can usually be expressed as a

fraction of the low premium, and the reserve during the first stage can then be graduated from one-half up to that fraction of the premium. For a scale of increasing premiums calculated on the basis of taking the ordinary uniform premium for four years older than the age at entry as the premium payable after the first five years, I found that the proportion of the low premium required on transfer varied from  $\frac{6}{5}$  to  $\frac{5}{4}$ , according to the age at entry. It appeared, therefore, that an ample reserve would be made by taking a premium and a half for policies in their fifth year,  $1\frac{1}{4}$  for those in their fourth, one for those in their third,  $\frac{3}{4}$  for those in their second, and  $\frac{1}{4}$  for those in their first year. The policies were classified according to their year of issue, and all that was necessary in valuation was to take the above-mentioned proportions of the total premiums in force. Each year the new issues would be written up, and the residue of those issued five years earlier would be transferred. To the above-mentioned reserve it would be necessary to add the value of any bonuses that had been declared, but this point would not arise in a quinquennial valuation, as none of the policies in force in their first stage would have previously participated.

*Endowment Assurances subject to increasing, decreasing or limited premiums.*—These assurances, being few in number, can be classified with the ordinary endowment assurances without sensibly disturbing the application of Z. The net premiums to be scheduled (subject to the usual limitation as to negative values) will be, in increasing premium cases, the ultimate office premium less the loading on a corresponding policy at uniform premiums in the same year as the sum assured and a negative premium equal to the excess of the ultimate office premium over the low premium in the year in which the first stage ceases; in decreasing premium cases, similar premiums, except that the excess of the high premium over the ultimate premium will be scheduled as a *positive* net premium in the appropriate year; in limited payment cases, a negative net premium for the loading in the same year as the sum assured and the office premium in the year in which it ceases. Mr. Chatham states that an extra column would be required for the whole-term loading, and proposes to neglect it, but that is not necessary.

*Double Endowment Assurances.*—In theory the valuation of these assurances by groups, arranged according to the year of maturing, presents some difficulties. It is necessary to take some account of the valuation-ages (or maturing-ages), for,



although the net premiums on policies for the same term bear a nearly constant ratio to the sums assured for the range of ages over which these assurances are effected, the policy-values decrease as the ages at entry increase. So far as the sums assured (exclusive of the extra endowment) and the premiums are concerned, Mr. Lidstone's  $Z$  would give a good average valuation-age, and, inasmuch as there would as a rule be no bonuses on policies of this description, the element of uncertainty attaching to the use of the same age for the sums assured and premiums could be eliminated by tabulating *two* columns of  $Z$ —one for the sums assured and the other for the premiums. Neither of the ages thus obtained would, however, be strictly appropriate for the valuation of the extra endowment. The first differential coefficient of  ${}_nE_x$ , the factor by which the endowment would have to be multiplied, varies as  $c^x \cdot {}_nE_x$ . Its rate of increase is, therefore, less rapid than that assumed by Mr. Lidstone for the first difference of the temporary annuity, and is subject to increasing retardation as  $x$  increases. Consequently the use of  $Z$  would give too high an age and too low a value for the extra endowment. In theory, therefore, the only method of obtaining an entirely satisfactory result appears to be to tabulate a third column of special valuation functions for the extra endowments; that is, to schedule the products  $K \times D_{x+n}$ , where  $K$  is the extra endowment and  $x+n$  the maturing-age—which brings us back to Herr Altenburger's method. In practice, however, it would probably be considered sufficient to use a single average-age, determined by scheduling  $Z$  for the sums assured only, for sums assured, endowments and premiums. The ages at which the endowments mature are not, as a rule, advanced, consequently the retarding effect of the factor  ${}_nE_x$  does not have much influence. Some offices have on their books endowment assurances with extra endowments (or "tontine bonuses") of amounts varying from perhaps 25 to 100 per-cent of the regular sum assured. To a miscellaneous collection of this description no general rule can be applied, as the distribution of the endowments follows no law, but, in dealing with a particular collection, I found that the President's plan, of obtaining an average valuation age by weighting the maturing-ages with the sums assured, answered very well for one or two representative groups. In such a case, however, the only really satisfactory plan would be to schedule  $K \cdot D_{x+n}$ .

*Joint-Life Assurances.*—Policies of this class are very unequally distributed over the offices—not only in absolute

numbers, but also relatively to the volume of business of other descriptions. In three or four offices they are exceedingly numerous, in others they are practically unrepresented; in many offices they are numerous enough to give a great deal of trouble, but not enough so to admit of special classification. In the first-mentioned case, their claim to a separate classification on an equal-ages basis must be conceded. In the other cases, I do not think that there would be any very serious objection to including them in the single-life whole-term schedule under substituted years of birth. On the basis of a mortality table following Makeham's law,  ${}_nV_{xy} = {}_nV'_w$  where  $w$  is found by the relation  $\mu_w = \mu_x + \mu_y + \log_e s$  and  $V'$  is calculated at a rate of interest somewhat higher than that employed in calculating  $V$ . There would be no difficulty in calculating  $w$  either from a prepared table or by reference to a joint-life annuity table and the corresponding single life tables at rates of interest  $\frac{1}{2}$  and 1 per-cent higher, and the result of scheduling the joint-life policy as a policy on a single life effected at the substituted age would be—in the case, for example, of an  $H^M$  3 per-cent valuation—that a reserve at a rate of interest a little below  $2\frac{1}{2}$  per-cent would be made. This, at any rate, would be an error on the safe side. The only alternative appears to be an individual valuation, which is rather troublesome when two or three hundred policies are involved.

*Contingent Assurances subject to annual premiums.*—No method of dealing with these policies otherwise than by individual valuation—or by the rough method of reserving a proportion of the premiums paid—has, so far as I know, been adopted in life office valuations. They are, however, numerous enough in some offices to demand special attention. At the present time they are, I believe, almost invariably valued by the Carlisle Table. One reason for this may have been similar to that which dictated Hobson's choice, another that the  $H^M$  Table has been held to be entirely unsuitable for the purpose. Although the  $H^M$  Table is quite unsuitable for the calculation of premiums for contingent assurances, it does not, I think, follow as a necessary consequence—in the case of contingent assurances any more than in that of ordinary life assurances—that it would be an entirely unsuitable instrument for valuation. Moreover, inasmuch as the value by a Makeham Table of a continuous contingent assurance subject to a continuous premium bears a constant ratio (that is, a ratio depending only on the difference of the ages) to the value of a similar joint-life assurance, and as the  $H^M$  Table throughout the

greater part follows Makeham's law fairly closely, it would be very convenient if the  $H^M$  Table could be adapted to the valuation of contingent assurances. Partly with the object of investigating this question, partly with the object of ascertaining whether the Carlisle Table is a satisfactory instrument for the valuation of contingent assurances, I decided to calculate the values of a few contingent assurances for selected ages at entry by the combination of tables (Dr. Sprague's  $H^M$  Select Table and the Government Female Annuitants Analysed Table) employed by the late Mr. Sunderland in the calculation of risk premiums for these assurances. Having access to Mr. Sunderland's working-sheets, I was able, without much trouble, to recalculate the necessary functions at 3 per-cent, by multiplying his 4 per-cent values of

$C_{[x]+n}^1 \cdot [y]+n$  and  $D_{[x]+n}^1 \cdot [y]+n$  by the appropriate powers of  $\frac{1.04}{1.03}$ .

The alteration of the rate of interest would not have been necessary for the purposes of the present investigation, but it had the incidental advantage of admitting of the calculation of the single premiums by Mr. Sunderland's method at a rate corresponding to present-day conditions; the annual premiums are, of course, only very slightly affected by the rate of interest. The revised columns of C and D gave both the select single and annual premiums and the non-select single premiums and annuity-values required for calculating the policy-values. The resulting values are shown in the following table, in which are inserted for comparison, the Carlisle values :—

Ages		S.S.M. v. G.F.A.A. 3 per-cent				Carlisle 3 per-cent	
$x$	$y$	$A_{[x][y]}^1$	$P_{[x][y]}^1$	$A_{xy}^1$	$a_{xy}$	$A_{xy}$	$P_{xy}^1$
20	40	·17827	·01063	...	...	·15684	·00972
30	50	·16853	·01164	·17192	13·195	·16521	·01219
40	60	·16697	·01459	·17160	10·119	·15494	·01515
50	70	·16121	·01995	·16920	6·654	·13883	·01892
60	80	·16473	·03099	·16410	3·689	·16481	·03510
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20	50	·14288	·00975	...	...	·12423	·00888
30	60	·11857	·01004	·12214	10·498	·11669	·01108
40	70	·10029	·01191	·10450	7·035	·10226	·01361
50	80	·08784	·01566	·09137	3·967	·07873	·01558
<hr/>							
20	60	·10830	·00915	...	...	·08729	·00810
30	70	·07487	·00874	·07783	7·182	·07812	·01020
40	80	·05570	·00972	·05690	4·098	·06471	·01269

The next step was to calculate the policy-values. For purposes of comparison with certain results obtained by the use of the  $H^M$  Table I have tabulated  ${}_nV + \frac{1}{2}P$  — the policy-value of practice. The results are as follows:—

VALUES OF  ${}_nV_{[x][y]}^1 + \frac{1}{2}P_{[x][y]}^1$ .

Ages at Entry		H <sup>M</sup> (5) v. G.F.A.(4) 3 PER-CENT				CARLISLE 3 PER-CENT			
		Years in force				Years in force			
<i>x</i>	<i>y</i>	10	20	30	40	10	20	30	40
20	40	·02634	·05872	·09315	·11957	·03832	·06039	·07234	·12402
20	50	·01491	·03103	·04782	...	·02766	·03999	·03830	...
20	60	·00754	·01483	...	...	·02014	·02745	...	...
30	50	·04799	·08593	·11534	...	·03638	·05546	·11366	...
30	60	·02885	·04652	...	...	·02451	·02826	...	...
30	70	·01671	...	...	...	·01779	...	...	...
40	60	·06482	·10298	...	...	·03521	·10124	...	...
40	70	·03817	...	...	...	·01676	...	...	...
50	70	·08053	..	..	...	·08544	...	...	...

On the assumption, which I think will be generally admitted, that a valuation by a combination of the  $H^{M(5)}$  and Government Female Annuitants Tables, the net premiums valued being those obtained by a combination of the corresponding Select Tables, affords the best available measure of the proper reserve for contingent assurances, it appears that the Carlisle values come very badly out of the comparison. For the oldest attained ages they run fairly smoothly, and more or less closely to the values given by the combination of tables, but at the younger ages—especially for the important ages 30 and 40 at entry, and the shorter durations—they are generally much lower than the combined values, while throughout the history of almost any policy they progress in a very erratic fashion. I now give the  $H^M$  values of  $k({}_nV_{xy} + \frac{1}{2}P_{xy})$  where  $k$  has a value independent of  $n$  and constant for all equi-different values of  $x$  and  $y$ :—



VALUES OF  $k$  ( ${}_nV_{xy} + \frac{1}{2}P_{xy}$ )  $H^M$  3%.

$k$	Ages		Years in force			
	$x$	$y$	10	20	30	40
·175	20	40	·03426	·06942	·10411	·13242
·075	20	50	·01967	·03750	·05227	...
·025	20	60	·00861	·01505	..	...
·175	30	50	·04681	·08911	·12364	...
·075	30	60	·02597	·04541	...	...
·025	30	70	·01071	...	...	...
·175	40	60	·06207	·10780	...	...
·075	40	70	·03242	...	...	...
·025	50	70	·07735	...	...	...

The use of a uniform value of  $k$  for combinations of equi-different ages is based upon the proposition enunciated above, but the actual values of  $k$  have been selected more or less arbitrarily.\* The resulting policy-values appear to me to compare more favourably than the Carlisle values with the values obtained by the combination of tables, and the conclusion at which I arrive is, that it would be fairly satisfactory to value a contingent assurance for which the difference in age is, say 30 years, by the  $H^M$  Table as a joint-life assurance for  $7\frac{1}{2}$  per-cent of the amount. At any rate, it could not be less satisfactory than to employ the Carlisle Table. From the joint-life assurance it is a simple matter to pass, as already explained, to a single-life assurance at a higher rate of interest, so that if it were considered admissible to value the contingent assurances at a somewhat lower rate than that employed for other assurances, it would be possible to classify them as ordinary whole term policies for reduced amounts.

*Annuities.*—The valuation of annuities by an analysed table is troublesome, as each contract moves four times before it finally settles down in the “4 years or more in force” class, and offices with a large number of annuities on their books might find it

\* The values of  $k$  in the formula  ${}_n\bar{V}_{xy} = k {}_nV_{xy}$ , where both values are by the Text-Book graduation of the Makeham Table, for differences of 20, 30, and 40 years in the ages, would be ·1388, ·0608, and ·0253.

rather a strain to value them all as select. A simple plan would be to schedule in each case the excess of the value by the select annuity over the value by the non-select annuity, to value them all as non-select, and add  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$  and the whole respectively of the total scheduled excesses for the four years preceding the date of valuation.

I have now reached the conclusion of these notes, and by way of apology for having traversed a good deal of ground which is not altogether new, I would point out that the minor practical questions to which they relate have been very little discussed by the Institute. In Mr. Chatham's Messenger Essay, to which any student of the subject must be largely indebted, as well as in such papers as those of Mr. Searle, Mr. Schooling, and Mr. Rea, larger questions have distracted attention from the practical details of classification and valuation. Yet I feel sure that many offices must have short practical methods of dealing with special policies, and it is partly in the hope that in the course of discussion some of these may be placed at the service of myself, in common with other members of the profession, that I have ventured to submit for consideration those that I have met with in my own experience.

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#### DISCUSSION.

The PRESIDENT said that in his paper Mr. Todhunter had deliberately taken up the position of a practical reformer, and, like all practical reformers, he must not be disappointed if his proposals did not receive ready acceptance. On one point they would all agree, namely, the uselessness of scheduling the total premiums paid on special policies, and the trouble and annoyance which that requirement entailed. When that Act was passed in 1870, special policies were very few in number, and there was not much trouble required in taking out the amount of premiums paid, but now special policies were becoming the rule and not the exception. Endowment assurances were taking the place of the ordinary policies, and whole-life policies were taking the place of the specials. Probably if the Institute were to approach the Board of Trade and urge that the schedule should, in this respect, be amended, they would be received with that courteous attention which they had always had from them. He hoped that some measure of the kind might be taken by the Institute.

Mr. R. P. HARDY said that the innocent title of the paper gave no indication of the heretical views it contained, nor did it supply any hint of the grave retrogression in certain points of actuarial practice which it advocated. Mr. Todhunter, adopting a well-known

and permissible rhetorical device, cited the Life Assurance Companies Act into court, and, as prosecuting counsel, and under cover of arraignment of its forms, he implicitly impugned those methods of exhibiting valuation results which experience had elaborated, and which daily practice had shown to possess the highest conveniences and potentialities. And in lieu of the present simplicity, which was even elegant in its details, the author proposed to substitute—he desired to do him no injustice, and stood open to correction—a heterogenous, structureless, colourless mass of values, without common relation to the facts assessed—what he would venture to call a veritable actuarial Olla Podrida. He would ask them to recall for one moment—for he had been present at some of the preliminary discussions—what brought the Act of Parliament into existence? One of the reasons, not the only reason, but at least one reason, was to reduce the prevalent chaos to order, and to make individual fancies give way to a methodical and analysed statement of affairs upon a common form. That statement, it might be remarked, was the logical exhibition of the values of the obligations reciprocally prevailing between two contracting parties. It was only a proper recognition of the privilege bestowed by the State upon a corporate body that they should, in their turn, render a complete statement of their affairs. But the Act had most judiciously left both the standard of measurement and the treatment of results to the responsibility of those officially concerned. What were the reasons—if one might dare to look into another man's mind—which induced Mr. Todhunter to challenge the fundamental principles which underlay that form? He ventured to think that Mr. Todhunter could scarcely in his heart suppose that the Board of Trade would sanction a common resort to the 9th clause, and so permit a nullification of the plain intentions of the Act in prescribing a common form of return. Neither did he think that Mr. Todhunter could suppose that Parliament would undo its work by restoring freedom of individual action, which would be condemned by public opinion, and which was sure to be abused; nor that Parliament would tamper with the integrity of the Act by even such small modifications as the President himself had referred to under the present state of things. He could not treat seriously Mr. Todhunter's complaint about the work involved, even if that complaint were well founded, which, he would venture to suggest, was scarcely so. As for the use of prepared tables of policy values, he would not stop to discuss that idea; it was simply bad, blind work, which, when he dealt with those things, he never allowed a pupil of his to use. The difficulty which he had found, and which he was sure all had found that had to be responsible for valuation results, was not the labour, but to discover when the results were obtained what they really meant, and to know how they should be dealt with practically. The trouble was not in the labour, but in the mental actuarial work. He therefore thought they might dismiss all views of that nature as having no real basis, and fall back upon the inevitable conclusion that Mr. Todhunter considered that the financial position was better represented either by a different collocation of values or by a combination of those now shown separately, and that certain other

values and the results of some customary enquiries might probably be jettisoned without any claim upon the underwriters as being the object of a merely unintelligent curiosity. To come down to specific particulars, he would deal with Mr. Todhunter's proposal of what he—Mr. Hardy—called massing values. It was not a very happily conceived term, but he thought they would all understand it. He maintained that it was never good work to throw together a variety of values which had no relation to each other. The true principle was to keep together all results deduced from the same formula, or obtained under a common measurement. It might be added that, since a non-participating profit outcome might be put against the expenses and contingencies—he did not wish to touch upon any controversial matters—both that past source of profit and probable future source should be clearly distinguished in every valuation. If they did otherwise, they lost all sense of proportion in the composing elements, and gratuitously threw away the opportunity of drawing deductions that were both excellent arithmetical checks upon the accuracy of their work and considerable enlighteners of the financial outlook. Then there came the question of the ear-marking of the sources of profit. He understood Mr. Todhunter to object to the exhibition of the so-called profit and loss upon mortality. He could not understand how any actuary could minimize the importance of that most instructive enquiry. He should hardly have thought that that needed any defence at all in that room. In his humble view, it could not be done too carefully, nor too minutely; and he would strongly urge upon all students that, instead of neglecting so important an analysis, they should rather cultivate it with all possible assiduity. It was his personal opinion that that should be done, if possible, for the various classes, because the question of mortality became of great importance in the case of the endowment assurances, where the relieved death-rate affected the reserves that should probably be held on account of the endowment portion of the contract. Then they came to the question of the valuation of the gross premiums, on which Mr. Todhunter had delivered so formidable an attack. He did not think it politic to teach students to arrive at the capitalized value of the "loading" by an indirect process. Such an estimate was liable to be deflected to the extent of half a year's purchase, and with £100,000 a year the small amount of £50,000 slipped in the operation; and, even when the calculation was properly made, it required both a preliminary study of the materials and some skill in the application of the methods. He agreed with Mr. Bailey that, in the absence of the value of the gross premiums, neither the conditions of the contract nor the possible official resources were adequately shown. Certainly, in some cases—he had seen them himself, and there would be a great many more under the  $2\frac{1}{2}$  per-cent valuations—where the office premium was less than the net premiums, it would be necessary to operate upon the gross value. There was another reason why that value should be ascertained. That was a problem which would have to be faced, namely, when one had to consider whether the method of dividing profits *inter partes* was still applicable under the altered or altering circumstances. It then became necessary to capitalize both the loading and also the interest



profit to be made over the valuation rate, and to put such resources against the value of the bonus rights to be dealt with. He wanted to know how they were to deal with that very important question in the absence of the value of the gross premiums. Those were only a few of the various uses to which that function could be put. They were all, in his view, of too great importance to be passed over upon the insufficient ground of the saving of clerks' labour. He hoped they would all maintain the principle of the detail of individual affinities, both in the schedules and in the valuations, as opposed to the massing of multitudinous dissimilars. He also hoped that they would declare that the results of any valuation, both as a measure of the past forces, and as an indication of their future play, could be studied and responsibly dealt with only by an examination of the individual composing groups.

Mr. G. J. LIDSTONE agreed with Mr. Todhunter that it was becoming increasingly necessary that they should have annual valuations, or, at all events, interim valuations for their own guidance, although, of course, not for publication. He thought, however, that such valuations should analyze as well as determine the amount of the surplus, and that an approximate estimate of the profit and loss from mortality had far more than the "academic value" that Mr. Todhunter assigned to it. With regard to the valuation of the office premiums, although he did not attach quite so much importance to that as did Mr. Hardy, he should be sorry to see it disappear altogether from the returns, but he thought the method which Mr. Todhunter had indicated would be in most cases quite sufficiently accurate. He had found the following results in the case of his own office:—For whole-life policies, 14·00 years' purchase of gross premiums, 13·93 years' purchase of net premiums. In endowment assurances the figures were still closer—office premiums 12·28 years' purchase, net premiums 12·26 years' purchase. He thought they would always be very close, and further that the error would be in the direction of under-estimating the value of the office premiums, because premiums depending on young lives usually contained the largest proportionate loading. He agreed with Mr. Todhunter that the "calculation of the total premiums received" was very laborious and utterly useless, and therefore vexatious. Anything that could be done to eliminate it should be done. He would also suggest another alteration which appeared to him unobjectionable, which would save a great deal of labour. At present, under schedule 5, they had to give a valuation of the gross sums assured, and to show the value of the re-assurances as a deduction, without any details of that deduction. It seemed to him it would be quite as satisfactory if the valuation in schedule 5 were to relate entirely to the net figures, the particulars of re-assurances being given in schedule 6 as at present. There was no doubt that if they properly approached the Board of Trade, any recommendations they might make for reasonable modifications of the Act would be adopted, but he thought that fresh legislation was necessary. He was entirely unable to agree with Mr. Todhunter's construction of sections 7 and 8. To say that although the Act required that the returns should be made in a certain form, yet it did not require all the columns in that form to be filled up, seemed to

him to be very much like the time-honoured sport of driving a coach-and-four through an Act of Parliament, and somewhat unworthy of the Institute. The interpretation of section 9 was perhaps a little more open to question, but his own view was that it must be taken as a whole, and that it was not intended to do more than give the Board of Trade power to make modifications which might be necessary in order to enable the Act to work better in relation to companies doing business on special lines—lines which were not at the time foreseen—but which might very easily arise. It was not likely that a general discretionary power of altering the forms would be given by a few words at the fag-end of a clause, the greater part of which clearly related to special cases. But even if they thought that discretionary power was given, it would not be desirable that it should be applied so as to enable every company to give its returns in its own way. It had been well said that the keynote of the Act was freedom and publicity, but publicity had been made effective by uniformity in the presentation of the results. He thought any alteration which might be made should apply to all the companies equally, so that uniformity should be maintained. As to the desirability of the particular modifications which Mr. Todhunter had suggested, there might be a difference of opinion. Mr. Todhunter himself had said in his paper that it was no part of his purpose to demonstrate that they were *desirable*; but one might remark in passing that he had certainly demonstrated that they were not *necessary*, because he (Mr. Todhunter) had recently conducted what he had described as a very complicated valuation, and had been able to get out the results in six days. That was no mean performance, and he would be very glad to know how it was done. He did not like Mr. Todhunter's suggestion that classes of policies differing so widely in their nature as whole-life policies, endowment assurances, and so on, should be amalgamated. It might be true that in many cases the profits were pooled, but, as Mr. Todhunter had himself admitted, it was desirable from time to time to see how far the pooling was equitable. He thought the best way to do that was by an annual, or at any rate a periodical, valuation. He also thought, for many reasons, that it was desirable that the value of the sums assured and the net premiums should be kept separate. Herr Altenburger's method as applied to endowment assurances was one which had impressed him very favourably when it first appeared in the *Journal*, but subsequent consideration had led him to think that it was inferior in practical convenience to methods based on a classification according to the unexpired term of the assurances. The great objection to the method was that it required two auxiliary functions, generally more, and that one of them depended on the bonus additions, and consequently changed at each valuation. It would, however, be useful in the case of an industrial company. The method also had a very useful application in the case of whole-life assurances subject to limited premiums, because it avoided the double classification which was necessary if the Z method were applied. With regard to the subject of limited payments he would mention an approximate method which he had used for testing in a rough way the value of the whole-life loading. If they deducted the total *values*



of the sums assured from the total sums they would get the value of an annuity-due of  $d$  per annum on the sums assured. The average annual loading could be determined without much difficulty, and if they reduced the value of  $d$  per annum in the ratio which the average annual loading bore to  $d$ , they would get the approximate value of the actual loading

$$\begin{aligned} [\Sigma \text{Val S.A.} &= \Sigma (\text{S.A.} \times \overline{1-d(1+a)})] \\ &= \Sigma [\text{S.A.} - d \text{ S.A.}(1+a)] \\ \therefore \Sigma \text{S.A.} - \Sigma \text{Val S.A.} &= \Sigma (d \text{ S.A.} \times \overline{1+a}) \end{aligned}$$

He found those results different by only 3 per-cent to 5 per-cent from the actual figures; it was a rough check, but distinctly useful. With regard to double endowments, all that was necessary to make the Z method applicable was to decrease the ratio on which the table of Z was based. He had taken out the values of double endowments, and he found that the differences roughly increased at the rate of about 50 per-cent for each five years of age, corresponding to an annual increase of  $8\frac{1}{2}$  per-cent. As the class of double endowments was not a large one, he thought that results amply sufficient for all practical purposes could be obtained by using the Z method, basing it on a ratio of  $8\frac{1}{2}$  per-cent per annum, or, perhaps, to be on the safe side, 8 per-cent per annum.

Mr. T. G. ACKLAND said that the paper divided itself distinctly into two parts: one relating to the provisions of the Act of 1870, and the other, and, as he thought, the more interesting, that relating to the valuation of special policies. There were official reasons why he should be guarded in his reference to the first part of the paper, but at the same time he wished it to be distinctly understood that his silence in respect to details or principles was not to be taken as implying assent to the propositions which Mr. Todhunter had laid down in respect of the provisions of the Act of 1870. It was somewhat curious that on the last occasion the Institute met they had a paper from Mr. Faulks, in which he somewhat strongly urged that there should be a rigid literal observance of the Act, to an extent which some members considered extreme; whilst on the present occasion they had from Mr. Todhunter a paper in which he took precisely the opposite view, and suggested that there should be a very loose and elastic reading of the Act. If they took the happy mean between those two views, they would perhaps not be far from the truth. It was the less necessary for him fully to discuss this matter, because it appeared to him that the premises upon which Mr. Todhunter's arguments were based were somewhat fallacious. He argued first of all as to the necessity of completing a valuation with all possible speed. Mr. Hardy had already referred fully to that point, but he would like to add one or two further words. It did not seem to him there was so much hurry for the completion of a valuation; it was not absolutely necessary that they should close their books at midnight on the 31 December, and complete their valuation before daylight on the 1st of January. He thought the true motto was *festina lente*—they should hasten slowly. Mr. Todhunter also referred to the desirability of elasticity of valuation methods. There,

he thought, he need add nothing to what had been said so ably by Mr. Hardy with regard to the desirableness of a rigid maintenance, so far as practicable, of the uniform pattern laid down in the Act, and the undesirableness that there should be any looseness brought into the reading of an Act of Parliament; and there must not, he thought, be a too confident reliance on the Board of Trade in that respect. Moreover, it seemed to him, with regard to Mr. Todhunter's point as to the impossibility of applying special methods of valuation, with a due regard to literal compliance with the Act, that his argument was not well founded. Any of the special methods referred to could be employed, as Mr. Lidstone had said, at interim or annual valuations; but even if they were employed on the occasion of the quinquennial valuation, he thought it was feasible, under almost any of these methods, to ascertain separately the value of the sums assured and the value of the net premiums. As an example, he might remind the members that Herr Altenburger in stating his special method specifically went out of his way to show how the value of the sums assured could be separately ascertained; and they were all familiar with the fact that Mr. Woolhouse, in giving his elegant and valuable method for an approximate valuation, also went out of his way to deduce separately the value of the sums assured, and the value of the net and office premiums, so as to meet the requirements of the Act. He agreed with Mr. Hardy that the distinction of classes in the valuation schedules was most important, and deprecated the mixing of different classes; and he knew of a case where, the paid-up policies having been mixed up with the whole-life assurances, an important error arose from the application of the troublesome "negative net premium" method referred to in the paper, which error was not discovered until after the returns had been printed. With regard to the matter of special policies he was able to speak more freely and in a more laudatory tone. Some of the methods which Mr. Todhunter had brought before them were, undoubtedly, very ingenious, and deserved at their hands a great deal of thought and study. The application of Mr. Lidstone's function "Z" to the valuation of limited premiums struck him as an ingenious and new suggestion, and one which could not but afford a satisfactory approximation. He had found no difficulty in valuing joint-life assurances by equivalent equal ages, which were very readily ascertained, and the valuation was practically as rapid as that of the whole-life policies when summarized. He saw no reason why they should go out their way to attempt to apply in the case of joint lives the method of deducing an equivalent single age, which could not but give an unsatisfactory and erroneous result. For the valuation of the contingent assurances, the method suggested struck him as a very happy one, which was well worthy of further consideration. The employment of the Carlisle table for the valuation of contingent assurances was very unsatisfactory, although probably it was their only present resource; but he hoped that the time might not be very far distant when contingent assurance tables based upon the New Joint Experience might be available for their use. With regard to the annuities, he could not follow Mr. Todhunter's suggestion that there was any particular difficulty in the employment of

Mr. Finlaison's annuity tables. If the annuities effected since the last valuation were scheduled according to the years of entry they would be able directly to apply Mr. Finlaison's tables. Cases effected in the last year of entry would be valued as select annuities; those in the next preceding those in year of entry, as cases with one year elapsed since selection; and so on; whilst cases effected more than four years ago would be valued by the tables for annuities having four years' duration and upwards. It would, however, be interesting to know what methods were actually followed by the several offices in the practical employment of Mr. Finlaison's tables. A suggestion had been made that a sort of average table could be employed, based upon the aggregated experience of the first four years following purchase, as deduced from Mr. Finlaison's data, and that such a table could be employed for the valuation in one class of the whole of the annuities effected since the date of the last valuation. He believed there was an analogous table in existence in connection with the H<sup>M</sup> experience, but he did not think that this method would on the whole be so satisfactory, in the valuation of annuities, as that which he had previously suggested.

Mr. H. A. THOMSON said the paper dealt with a great many interesting points. The amount of labour spent on valuations was certainly much greater now than formerly. The principal reasons for this were that annual valuations were becoming rather the rule than the exception, that special policies were largely on the increase, and that the liabilities were often valued on two separate bases owing to the fall in the rate of interest having caused a reduction of the rate assumed in the valuation. and to its being customary to value the liabilities on the old basis as well as the new when such a change was made. It was now nearly ten years since a company first adopted a 2½ per-cent net premium valuation, and as the rate of interest had fallen considerably in the meantime, they might before long hear of companies valuing their liabilities at 2 per-cent. On account of the increased labour attending valuations, it was more important now than formerly to employ shorter methods and to put a more liberal construction on what had been deemed the hard and fast requirements of the Act of 1870, with a view to the elimination of any unnecessary or laborious calculations. Mr. Todhunter attached very little importance to profit from mortality, and suggested that most of the special policies, both with and without profits, might be grouped with ordinary whole-life policies, so as to form one large class. He agreed with Mr. Lidstone that such a course would be from many points of view undesirable; one objection was that it would hide many interesting features; a comparison of the liabilities of a company at successive epochs scheduled in detail in the usual form in the Board of Trade returns was very instructive, and threw a great deal of light on the affairs of the company and the course of its business; this advantage would be lost if all the different classes of policies were grouped together. Another objection was that it would prevent the profit from mortality being ascertained for different classes separately, *e.g.*, endowment assurances. It was true that, as Mr. Todhunter pointed out, the question whether the profits of different classes ought to be pooled for the purpose of

allocating bonuses was one to be determined by investigation of the mortality experience under the different classes of policies, and by reference to the way in which the premiums were loaded. But an investigation of the rates of mortality experienced was rather a serious undertaking, while the profit from mortality, combined with a few calculations of a simple nature to obtain the profit from interest and loading, &c., would furnish a pretty safe guide from year to year as to whether the policies in any particular class were earning the bonuses which they were receiving. It was a very simple matter to get the profit of mortality by the "prospective and retrospective method" mentioned in the paper, which was considered by the author quite sufficient for any practical purpose, a view which he fully endorsed. The method had been described by Mr. G. F. Hardy seven years ago in the discussion following Mr. Ryan's paper on "Expected Death Strain"; it was very beautiful in its simplicity, and when they considered the heavy labour involved by the older methods and that this method only took a few minutes, he thought they might justly regard it as one of the many pearls of actuarial science for which they were indebted to Mr. G. F. Hardy. By means of this method, supplemented by a few simple calculations, it was found possible to allocate in a very short time the profits of a triennium in a Colonial company to their principal sources, namely, mortality, interest, surrenders, lapses, and loading, the amount of the profits was some £170,000, and the discrepancy about £200. He had tested the accuracy of the method by applying it to two closed series, and by also obtaining the expected death strain by a modification of Mr. Ryan's method. The results were for one series £22,245 and £22,354 respectively, and for the other series £14,264 and £14,317. In employing the method for any particular class of policies, it was necessary to look carefully after any transfers to or from that class during the year. He ventured to think that another reason for not classifying the special policies with the whole-life policies was that certain circumstances might arise which would necessitate disentangling them again, which would be a troublesome process. It was difficult to prophesy beforehand what the circumstances might be, but he could give one instance which occurred in the past year. The income tax authorities suddenly awoke to the fact that they ought to receive more income tax from a certain mutual company which transacted fire and life business. Apart from untaxed interest, they had previously been receiving tax on the profits from non-participating fire policies only; they now claimed income tax on the whole of the profits of the company, fire and life, arising from both participating and non-participating policies. They maintained that life assurance companies which were mutual only in the sense that there were policyholders who participated in profits, but without incurring any liability, were not exempt, as regards income tax, from any portions of the surplus. The officials of the company were of a contrary opinion. A correspondence went on fitfully for some years, without much result. The company offered to pay income tax on the previous basis, but the authorities refused to receive it, preferring to wait until the whole question was settled. Eventually an ultimatum was sent, and the income tax



authorities sought the arbitrament of the Law Courts. At the last moment, however, they withdrew, and renounced their claims, and consented again to treat. Diplomatic interchanges of views followed, and the company made a concession, namely, that they would pay income tax on the profits arising from their non-participating life policies (as well as non-participating fire policies) on the condition that the two should be pooled for the purpose of estimating the amount of tax payable. This was agreed to, and by Mr. Hardy's "prospective and retrospective method" the profit of mortality for the non-participating life policies was very easily ascertained, and adding the profit from interest, &c., the results showed that, for each of the years in question, a very handsome loss had been experienced. So that in the sequel the income tax authorities received nearly a thousand pounds less than they would have under the old arrangement, if they had not grasped for more. He mentioned that as a practical illustration of the advantages of keeping the non-participating policies apart from the participating policies in their valuations. He was inclined to disagree with the author's suggestion that a method which necessitated a large amount of skilled labour was not open to any objection on that score. He thought that the simpler the methods employed the larger would be the area of the staff over which the work could be spread, and consequently the less would any special pressure be felt, as, for instance, at the valuation epochs. He felt under a debt of gratitude to the author for the ingenious methods he had described, many of which would doubtless prove useful in practice. Without agreeing with Mr. Todhunter as to the desirability of some of the sweeping changes he proposed to introduce, as, for instance, the valuation of most of the different classes of policies in one group, he sincerely hoped that one of the main objects of the paper would be attained, namely, that, without violating the spirit or intention of the Act, a more elastic interpretation of some of its provisions would be secured, thereby eliminating any useless information, such as "total premiums received", and probably also "value of office premiums."

Mr. E. A. RUSHER said there was one point in the paper which he could not allow to pass without joining in the chorus of disapproval which seemed to have arisen, and that was where the author stated that, "apart from its bearing upon the accumulated surplus, the mortality experience in the course of a year, or even a quinquennium, was of little practical importance, and when the surplus had been ascertained by direct valuation, the profit or loss on mortality became almost entirely a matter of academic interest." He had been for the last few years engaged in valuations of a large company, and he felt it to be a matter of the very greatest importance that the profits under each class of assurance should be traced to their source as far as practicable. Amongst those sources of profit, one of the most important to be watched was that of the profit or loss from mortality. With reference to what Mr. Thomson had said about Mr. Hardy's method of ascertaining the profit, in the valuation to which he referred they began by using that method, but discontinued it because it appeared to throw so many of the miscellaneous sources of profit into the profit from mortality. It really was not a very

long task, if an annual valuation was being made, to obtain the figures in the ordinary way. That had been done in a large office for some years past, and by means of that and analyzing the other profits they had brought the matter to such a pitch of perfection that they accounted for the profits to within 1 per-cent. It seemed to him that the question of labour was not so much in the valuation itself as in the obtaining of the particulars for the valuation. That was a point which would occur whether they used these modifications which Mr. Todhunter proposed or not. The labour of obtaining preliminary facts of valuation would still be great. The actual valuation, once they had the particulars, was comparatively a small matter. He felt that the massing of different classes of assurance which Mr. Todhunter so earnestly put forward, would destroy a great deal of the value of their results.

Mr. GEO. KING did not propose, at that late hour, to go into any of the details touched upon by Mr. Todhunter, but he would like to say one or two words upon the general question. While he admired very much Mr. Todhunter's paper, and thought he had performed a useful service in bringing it forward, he was, nevertheless, of opinion that, to a certain extent Mr. Todhunter had lost sight of the real objects of the Life Assurance Companies Act. He conceived that one of the main objects of that Act was to place it in the power of independent experts to form a rough judgment of the position of a company, and the Act had very well served that purpose, and had been very useful. It was quite true that with the great majority of companies it was entirely unnecessary that any outside expert should be able to test their valuations. But the very fact of the power being placed in the hands of outside experts made companies more particular which would perhaps not otherwise be so careful. At one time it was his custom to examine very minutely all the valuation returns which came out, and only in two instances had he ever found any real flaw in the valuations. But in two instances he had found most gross mis-statements—whether wilful or unintentional he would not at present say,—and on each of those occasions the discovery of the mis-statement led to very great public good. He therefore thought that, although it was very rare that such events arose, it would be a great mistake on their part to recommend anything which would render their discovery impossible. He thought the schedules, as they had them, with perhaps some slight modifications which experience had suggested, were very useful in that direction, and, with all respect to Mr. Todhunter, his proposals materially to alter in various directions the usual interpretation of the schedules destroyed the benefits they conferred. He would, however, point out that the schedules in their present form did not impose upon actuaries the necessity of making their valuations in particular ways. For valuation purposes Mr. Todhunter was quite at liberty to group the policies together and value the whole-life policies and endowment assurances by one process if he liked, but when he came, nine months afterwards, to schedule them, he had simply to sort out the results of the different classes and put them in their right places in the schedule. Mr. Todhunter was not compelled to value his endowment assurance in a particular way, but he was asked to place separately the liabilities



under them, and he could not complain of that requirement. The question as applied to interim valuations was not of great importance, because he did not think it was the custom, in this country at any rate, to make detailed interim valuations. From a valuation made as at the end of the quinquennium, coupled with the valuation made at the beginning, they could get a very closely approximate result for each year of the quinquennium, and they had then only to deal with the exits and entrants in each particular year, and all the work of valuing as at the end of the quinquennium came in useful for the valuation which then had to be made. He did not think the power given in section 9 of the Act of 1870 was intended to modify the schedules to meet the views of individual actuaries. It was meant that all companies doing approximately the same kind of business should make their returns as nearly as possible in the same form, but that section came in very usefully when a very special class of business had to be dealt with. He had himself met with that in his experience in the case of the Pension Fund for Nurses. There it was found impossible to apply the rules indicated in the schedules of the Act, and he had made the valuation by the retrospective method. He had set it out to the best of his ability, explaining fully what had been done, and sent the returns into the Board of Trade, and they were at once accepted under section 9. It was for a purpose of that kind that he thought the section was intended, and not to alter the forms according to what might almost be called caprice. He would urge that if anything was done to render it impossible for outside experts to make a rough check on valuations, the only other course would be to have Government supervision, and he thought they would all deplore that. They must be able in some way or other to know that the statements made with regard to the valuations were correct. They had that at present by means of the schedules published under the Act. If the power to use the schedules for that purpose was taken from them, then he did not see how they could resist the institution of Government inspection, so as to certify that the methods of valuation, as explained by the company itself, had been properly followed.

The PRESIDENT proposed a vote of thanks to Mr. Todhunter for his very able paper.

The resolution was carried by acclamation.

Mr. TODHUNTER, in reply, thanked the members very sincerely for their reception—he would not say their favourable reception—of his paper. He had followed the discussion with very great interest, and had naturally much to say upon the numerous points which had been raised, but he felt that he ought not to trouble them with any further opinions upon the general questions which had been raised in the debate. He would leave his case as it stood, except so far as one or two points were concerned, in regard to which practically direct questions had been put to him. One of the most important was the point raised by Mr. King. He appealed from Mr. King to Mr. King's paper and his own. He was indebted to Mr. King's paper for his fundamental assumption. He had had in his mind, in writing the paper, the schedules which Mr. King had given in his paper. He had attempted to show that whereas the particulars which

were at present given in their returns, such as the total premiums received, were useless, the schedules which he recommended would enable an expert to make that very check valuation which Mr. King regarded as essential. Then, with regard to the analysis of profits, what he would say in reply to criticism on that point was merely *cui bono*? As a matter of fact, he wanted to know what was done with that complicated analysis of profits. He doubted whether any great expenditure of time upon the investigation of the mortality profit produced results of proportionate practical utility. At the same time he fully recognized that the results of such an analysis were of some interest, and he had recently analyzed the surplus in several classes by the prospective and retrospective method. Then there was the question as to how the valuation to which he had referred had been made in six days. The explanation was very simple—the whole work was done beforehand. By the middle of December every class that could be closed had been closed, agreed with the office records, and valued. The policies requiring individual treatment had been valued six months in advance. Mr. Hardy had referred to the danger of overlooking an office premium which was less than the net premium. In his paper he had mentioned the necessity of revising the net premium in such a case. He was the last person to believe in a check, but he did believe in a proof, and when anyone showed him that a perfect proof could be put upon any column of figures, he was quite satisfied to rely upon it.

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## LAW REPORT.

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[In his paper "On Lost Policies, &c." (*J.I.A.*, xxxiii, 373), Dr. Sprague mentioned the case of *Crawford v. Canada Life Assurance Co.*, in which the office was held liable to pay the surrender value of a policy to the trustee in bankruptcy, although it had previously paid the amount to the assured. Dr. Sprague informs us that the decision in this case was reversed on appeal, and through his courtesy and that of Mr. Sanderson, Assistant Actuary of the Canada Life, we are enabled to print a report of the case and the judgments of the three judges who decided the appeal. The report is taken from the "Ontario Appeal Report", No. 8, Vol. XXIV (Toronto, 1898).—Ed. *J.I.A.*]

### CRAWFORD v. CANADA LIFE ASSURANCE COMPANY.

*Chose in Action—Assignment—Notice—Life Insurance.*

A debtor, or trustee of a fund, is not responsible to an assignee of the creditor, or payee of the fund, for dealing with the latter persons without reference to the assignment unless it is found either that at the time of so dealing he actually knew of the assignee's title, or that he had previously received a

notice sufficiently distinct to give him an intelligent apprehension of the fact that the assignee had acquired an interest in the claim or fund.

A life insurance company issued two policies upon a man's life, one policy being payable generally and the other to his wife. The assured made an assignment for the benefit of his creditors, and the assignee, who at the time knew only of the policy payable generally, wrote to the company referring to this policy by number and informing them of the assignment. The assured's wife had died before the assignment was made and the policy in her favour had become part of the assured's estate and had passed to the assignee. A few weeks after notice of the assignment had been given to the company the assured informed them of his wife's death, and obtained from them the surrender value of the policy in which she was named as beneficiary. There was no imputation of bad faith, and the officers of the company swore that they had, at the time, no recollection of notice of the assignment for the benefit of creditors having been given:—

*Held*, that under the circumstances the company were not responsible for paying the surrender value of the policy to the husband.

Judgment of FERGUSON, J., reversed.

THIS was an appeal by the defendants from the judgment of FERGUSON, J. Statement.

The plaintiff was the assignee for the benefit of the creditors of one Donald Fraser, under an assignment made on the 25th of September 1895. and brought the action against the defendants, who carried on the business of life insurance, to recover the surrender value of a policy upon Fraser's life issued by them. At the time of the assignment for the benefit of creditors two policies upon Fraser's life were in force; the first, No. 39,118, for \$5,000, was payable generally, and the other, No. 41,572, also for \$5,000, was payable to the assured's wife. The plaintiff knew that the first policy was in force, but did not know that there was a second policy. On the 20th of December 1895, the plaintiff wrote to the defendants, a letter, headed "Re D. Fraser, En. Policy 39,118," stating that an assignment for the benefit of creditors had been made by Fraser to him, and asking the surrender value of the policy. The defendants answered that the surrender value of policy No. 39,118 was \$1,951, but that it had, as the fact was, been assigned to the Merchants' Bank of Canada.

Before the assignment for the benefit of creditors, Fraser's wife, the beneficiary named in policy No. 41,572, had died, and that policy was in fact at that time part of his estate. The defendants did not make in their books any note of the fact of Fraser's assignment, and in January 1896, on his application, and upon proof of his wife's death, they, in good faith, paid to him \$902, the surrender value of that policy.

The action was tried at Kingston, on the 19th of October 1896, before FERGUSON, J., who gave judgment in the plaintiff's favour, holding that sufficient notice of the assignment for the benefit of creditors had been given.

Statement—  
continued.

The appeal was argued before OSLER, MACLENNAN, and Moss, J.J.A., on the 17th of September 1897.

*Bruce*, Q.C., for the appellants.

*S. H. Blake*, Q.C., and *Smythe*, Q.C., for the respondent.

The following cases were cited and commented on: *Palmer v. Locke*, 18 Ch. D. 381; *Re Tichener*, 35 Beav. 317; *Lloyd v. Banks*, L. R. 3 Ch. 488; *Browne v. Savage*, 4 Drew, 635; *Ex parte Agra Bank*, L. R. 3 Ch. 555; *Alletson v. Chichester*, L. R. 10 C. P. 319; *Low v. Bouverie*, [1891] 3 Ch. 82; *North British Ins. Co. v. Hallett*, 7 Jur. N. S. 1263; *Ex parte Stright*, 2 Dea. & Ch. 314; *Société Générale de Paris v. Tramways Union Co.*, 14 Q. B. D. 424; *Saffron Walden, etc., Society v. Rayner*, 14 Ch. D. 408.

Judgment.  
Osler, J.A.

November 9th, 1897. OSLER, J.A. :—

The question is whether the plaintiff gave notice to the company that he was assignee of the fund, the policy No. 41,572, by the letter of the 20th of December 1895. I read that letter as sufficiently conveying to the company's secretary information that Fraser, the insured, had made an assignment to the plaintiff for the general benefit of his creditors under the statute, and that in that capacity he was entitled to policy No. 39,118. But has it any other effect? Take it in the sense most favourable to the writer, not restricted or limited by the reference to that policy. It is, then, a general notice of the fact that he had become assignee for the general benefit of the creditors of Fraser, a person insured in the company.

The company being then ignorant of the death of Mrs. Fraser, their knowledge at that time was that Fraser was the owner of policy 39,118, subject to the transfer thereof to the Merchants' Bank, and that Mrs. Fraser was the beneficiary of the policy 41,572, her husband not being interested therein. When, therefore, they were informed of Fraser's assignment for the benefit of his creditors, this conveyed to them no information as to the plaintiff's title to the latter policy. It was simply a fact irrelevant to it, so far as they knew, or had means of knowing. How, then, can it be said that notice was given by that letter that the plaintiff was the owner of the fund?

It is notice of that kind which is required to fasten the trustee with responsibility in dealing with the fund. The plaintiff was the person who knew, or ought to have known, of his right in regard to policy 41,572, and who should have informed the defendants of their changed position. The only notice he gave them would have, as far as would appear to them, had they upon its receipt



consciously applied it to that policy, no bearing upon it. Its effect would naturally appear to them to be exhausted when they had given the information requested as to the other.

Judgment.  
Osler, J.A.—  
*continued.*

It cannot, in my opinion, be held to have been such a notice as, in the language of Lord Cairns in *Lloyd v. Banks*, L. R. 3 Ch. 488, would lead them "to an intelligent apprehension of the nature of the encumbrance which has come upon the property." We cannot hold that the bald fact communicated was one which the company was bound to bear in mind in relation to it, and having been in fact forgotten, as the learned trial Judge held, when they came to deal with it afterwards on Fraser's title being brought to their knowledge, I think we must hold them not to have been affected by it, and therefore, with all respect to the learned trial Judge, must allow this appeal. I rely upon the case above referred to, and upon *Saffron Walden, etc., Society v. Rayner*, 14 Ch. D. 408.

MACLENNAN, J.A. :—

MacLennan,  
J.A.

The question in this case is the sufficiency of the notice to the defendants of the assignment to the plaintiff of the policy of insurance No. 41,572, dated the 25th January 1887, on the life of Donald Fraser. The notice relied on is the letter from the plaintiff to the defendants' secretary of the 20th of December 1895. and the answer thereto of the 24th of December. The letter of the plaintiff relates to a different policy on Fraser's life, and enquires the surrender value. It states that Fraser is insolvent, and that his estate has to be wound up, and the plaintiff signs it, "R. Crawford, assignee estate of D. Fraser." The fact was that the policy 39,118 had been assigned absolutely by Fraser to the Merchants' Bank, and the secretary answered the letter by stating that the surrender value was \$1,951, but that it had been absolutely assigned to the bank, and in consequence would not belong to the insolvent's estate. Now, the first observation to be made on this letter and the answer to it is that they had no relation whatever to the policy in question. The plaintiff's letter does not profess to be, nor was it intended to be, a notice in relation to it; and the fact being, that the policy enquired about had been absolutely assigned to the bank, there was no occasion for the secretary to give the matter further thought or attention after answering the letter. I think it would not, naturally or necessarily, bring to the secretary's mind any thought of the other policy, or that it might be affected by the assignment, but that, naturally, he would think no more about it; and it appears from Mr. Hill's evidence that that is just what happened; and even if

Judgment.  
 Maclellan,  
 J.A.—  
*continued.*

the enquiry had called up to his mind the thought of the other policy, he would probably have dismissed it at once from his mind, remembering that it was one for the benefit of Fraser's wife, and not for his own benefit. Nothing is more improbable than that he would reflect that if Mrs. Fraser happened to be dead, her husband might himself be entitled to the benefit of the policy, and that his interest might have passed by the assignment. On his wife's death Fraser might have appointed the policy in favour of his mother or his children, or some of them; and it did not necessarily follow that he had any interest in it at the time of the assignment. The truth was that Mrs. Fraser had then been dead for more than a year, but the company was not then aware of the fact. Upon the evidence it must be taken that when, about twelve days afterwards, D. M. Fraser, on behalf of the assured, enquired of Mr. Hill the surrender value of the wife's policy, and notified him of her death about two years previously, he had forgotten all about the plaintiff's statement, in the letter of the 20th of December, that Fraser had made a general assignment for the benefit of creditors. It may be that, even if he had remembered it, it would not have occurred to his mind that the assignment would have operated to transfer the policy to the assignee, for that was a question of law depending on the construction of the statutes relating to insurances for the benefit of wives and children. The interval between the two transactions was certainly short, but considering the large business of the defendant company, it is perhaps not surprising that in January Mr. Hill did not recall what had taken place in December.

Now, what the plaintiff must make out is, that when the defendants surrendered the policy to Fraser, and paid him the money, they had notice of three things; first, that Mrs. Fraser was dead; second, that the legal effect of her death was that the policy had become the property of her husband; and third, that the husband had assigned the policy to the plaintiff. Where notice has been distinct and explicit, it will not do for the party to say that he has forgotten it. He is bound to remember. But where it is not distinct and explicit, it is not his fault if the imperfection of the notice has left his mind and memory without the necessary impression. The notice or knowledge must be such as to make it just for a Court to hold that his conscience must be affected. I think that is the result of the authorities which have been cited to us.

In *Re Tichener*, 35 Beav. 317, Lord Romilly said: "There must be something bringing the encumbrance distinctly and clearly to the mind and attention of the trustee. It must amount to this: mind and remember this, and if any one enquires of you, inform him that the trust fund is encumbered. \* \* The notice must be



formal notice which the trustee is bound to remember.  
 \* \* Take notice that A. B. has encumbered the trust fund for £100, therefore take a note of that, in order that you may inform anyone who may enquire of you on the subject."

In *Ex parte Agra Bank*, L. R. 3 Ch. 555, Lord Hatherley said: "The point is whether or not it is in their capacity of directors, as agents and managers of the company, that the information is acquired, deliberately, formally, and for the very purpose of guiding themselves in their course of action."

In *Lloyd v. Banks*, L. R. 3 Ch. 488, Lord Cairns referred to the difficulty which the Court will always feel in attending to any kind of intimation which will put the trustee in a less favourable position than he would have been in if he had got distinct and clear notice. He then distinguishes between notice and knowledge, and says that there must be "proof that the mind of the trustee has been brought to an intelligent apprehension of the nature of the encumbrance which has come upon the property; so that a reasonable man, or an ordinary man of business, would act upon the information and would regulate his conduct by it in the execution of the trust. If it can be shewn that in any way the trustee has got knowledge of that kind, knowledge which would operate upon the mind of any rational man, or man of business, and make him act with reference to the knowledge he has so acquired, then I think the end is attained."

These were cases of notice to trustees of encumbrances upon the trust funds, but the law must be the same in a case like the present; and in *Alletson v. Chichester*, L. R. 10 C. P. 319, a case relating to a policy of insurance, the learned Judges intimate that the notice must be precise, that the matter must be distinctly brought to the attention of the company, and not incidentally. What is charged in the present case is partly notice, and partly knowledge. Notice of an assignment, and knowledge of the death, and that thereby the policy became the property of the assignor. But the notice was at a time when it required no attention, and the knowledge came after the notice had been forgotten.

I am, therefore, of opinion that the appeal ought to be allowed, and that the action should be dismissed.

Moss, J.A.:—

Judgment.  
 MacLennan,  
 J.A.—  
*continued.*

Moss, J.A.

The policy in question in this case, No. 41,572, bears upon its face a note that it is issued in terms of an Act to secure to wives and children the benefit of assurance on the lives of their husbands and parents. It recites that Donald Fraser, the person assured, proposed to effect the assurance for the benefit of his wife, Winnwood Mary

Judgment.  
Moss, J.A.—  
*continued.*

Fraser, and contains an agreement that upon the death of Donald Fraser, the policy having in the meantime been duly kept on foot by payment of the yearly premium, the defendants will pay to "the party for whose benefit this assurance is effected" the sums secured thereby.

Prior to the receipt on the 24th of December 1895, of the plaintiff's letter of the 20th of December, the defendants had knowledge that they had issued two policies upon the life of Donald Fraser which were then on foot; that one of them, No. 39,118, appeared to be absolutely assigned to the Merchants' Bank; and that the other, No. 41,572, was effected under the Act to secure to wives and children the benefit of life assurance, and was on its face for the benefit of Mrs. Fraser. But they did not know that she had died a year and a half or two years before, nor that on the 25th of September 1895, Donald Fraser had made an assignment for the benefit of his creditors under R. S. O. ch. 124, and amending Acts, to the plaintiff.

The plaintiff had on or before the 20th of December 1895, become aware that Donald Fraser had effected policy No. 39,118 with the defendants, but apparently not that it was assigned to the Merchants' Bank. And apparently at that time he had no knowledge of policy No. 41,572.

In this condition of things the letter of the 20th of December 1895, is written to and received by the defendants. It was received at the head office in Hamilton by Mr. Hill, the defendants' secretary, who, according to his own statement, has the office management to a large extent, and receives and deals with the correspondence.

He is one of the two persons named in a memorandum printed upon the defendants' policies as the only persons upon whom service is to be made of any notice or intimation of any assignment of, or charge upon, any policy. He was the proper person to receive the information contained in the letter of the 20th of December 1895, and that letter was received by him in the course of the transaction of the defendants' business, and in the course of his duty he replied to it by the letter of the 24th of December. The terms of that letter shew that there had been conveyed to Hill's mind a distinct intimation that Donald Fraser had made an assignment to the plaintiff for the benefit of his creditors, and that his estate was being wound up. And apart altogether from the distinct reference to policy No. 39,118 in the plaintiff's letter of the 20th of December, it imposed upon the defendants the obligation of attending to the effect of the assignment upon Donald Fraser's rights with regard to that policy, for, aside from the assignment to the Merchants' Bank, that policy formed a part of his

estate. But the letter gave no information as to the death of Mrs. Fraser, and in no other way drew attention to policy No. 41,572. In the then state of the defendants' information the fact of Donald Fraser having made an assignment had no significance with reference to policy No. 41,572, for with Mrs. Fraser living at the date of the assignment no right to the policy would have passed to the plaintiff. It was the fact, then unknown to the defendants, of the death of Mrs. Fraser before the date of the assignment, that had operated to vest the policy in the plaintiff.

Judgment.  
Moss, J.A.—  
*continued.*

Under these circumstances were the defendants justified in dealing with Donald Fraser with reference to the surrender by him of the policy instead of with the plaintiff?

If, at the time the defendants dealt with Fraser, there was in fact in their mind, or in the mind of their officer Mr. Hill, a knowledge or recollection of the assignment to the plaintiff, but they, nevertheless, had ignored him, and dealt with Fraser, they could not escape liability to the plaintiff. But Hill's testimony is that at that date he had forgotten the information given in the letter of the 20th of December about Fraser's assignment to the plaintiff. At first view this may appear strange, but there is no reason for thinking it incorrect, or for supposing that the defendants were colluding with Fraser to cut out the plaintiff's claim under the policy.

So that this is not a case of knowledge—apart from notice—of the fact of the assignment, existing in the mind of the defendants or its officers at the time of the dealing. It is a question of whether the letter of the 20th of December was, to use the language of Bramwell, L. J., "notice of such a character as that it would lead the defendants as prudent people to make it a part of their knowledge as a thing by which they were to govern their conduct in the future": *Saffron Walden, etc.. Society v. Rayner*, 14 Ch. D. 408, at p. 418.

If at the date of the receipt of that letter the defendants had been aware, or if by the letter they had been informed, of the fact of Mrs. Fraser's death, there would have been presented the question whether the information was of a character rendering it incumbent upon the defendants to retain it in their recollection in their subsequent dealings with policy No. 41,572. But in the absence of that knowledge or information, the letter made no call upon the defendants to connect the fact of the assignment with a policy which they had then no reason to suppose formed any part of Donald Fraser's own estate.

In the case referred to, James, L.J., puts the test in this way: "Was there a communication made to the trustees in such a way as to give them an intelligent

Judgment.  
Moss, J.A.—  
continued.

apprehension of the fact that they had received a notice which would make it untrue in them to say to anybody else that they had not received that notice?"

Applying this test, and supposing that between the 24th of December 1895 and the 3rd of January 1896 an enquiry had been made of the defendants whether there had been any assignment of, or incumbrance upon, policy No. 41,572, it would not, I think, have been an untruthful answer if they had stated "we have not been notified of any."

The case of *Leslie v. Baillie*, 2 Y. & C. C. C. 91, appears to support in principle the defendants' contention. There a lady entitled to a legacy and other benefits under the will of an English testator made in England, was married in Scotland to a domiciled Scotchman, who died before the legacy and other benefits became payable to or receivable by his wife. After his death and the happening of the events which under the will rendered the legacy and other benefits payable, the widow made application to the executors or trustees under the will for payment to her, and under the belief that she was entitled, as she was under the law of England, to receive the amounts as choses in action not reduced into the possession of her husband during his lifetime, they paid her. By the law of Scotland the marriage vested these choses in action absolutely in the husband, and the payments were, therefore, made to the wrong person. But upon a bill filed to compel the executors and trustees to pay over again, Vice-Chancellor Knight Bruce held them not liable. He treated the marriage as an assignment in fact, but held that notice of the marriage was not notice to them of the assignment, for they were not bound to know that that was the effect of the marriage.

Here notice of the assignment to the plaintiff was not notice that the policy No. 41,572 had by reason thereof vested in the plaintiff, for there was no notice of Mrs. Fraser's death.

There was, therefore, no obligation imposed on the defendants to retain in recollection the information as to Donald Fraser's general assignment to the plaintiff in their subsequent dealings with policy No. 41,572.

*Appeal allowed.*

R. S. C.

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## REVIEW.

*Lectures on “The Companies Acts.”\**

THE appearance in print of these lectures quickly following their delivery at Staple Inn Hall will be a boon to many members of the Institute, and particularly to those who have not yet attained the Fellowship but have aspirations in that direction. It must be borne in mind, however, that the courses of lectures provided by the Institute are intended to be educational in the broadest sense of the word, and do not attempt to supply students with an easy means of acquiring just enough information regarding the subjects dealt with to enable them to pass an examination. Indeed, in reading over these lectures, one is never reminded that such a thing as an examination exists. And this is as it should be. There is after all a difference between study for its own sake and the reading that is undertaken with one eye on the probability of an examination question arising out of a particular point of detail. Let the student first acquire a firm grasp of the fundamental principles of a subject, and the superstructure that is necessary to satisfy a Board of Examiners is easily erected—if the foundation is insecure the superstructure will hardly bear the searching criticism which it is sure to undergo.

Mr. Clauson's lectures deal with the various processes involved in the formation, management, and extinction of a company; and with the rights, remedies, duties, and liabilities of shareholders, promoters, directors, managers, creditors, and others connected or having transactions with companies. They are stated to have been prepared with special reference to the questions which actuaries, as officers of insurance companies, are likely to meet with in their daily practice. Various references are made to the Life Assurance Companies Acts, but the law relating to friendly societies, building societies, and industrial and provident societies is specifically excluded.

Rightly holding that no true knowledge of the present position is possible without an intelligent appreciation of the events and circumstances that led up to it, Mr. Clauson devoted his first lecture to a historical retrospect. A desire for increased facilities for joint stock enterprise arose out of the commercial activity of the early years of the eighteenth century, and the conflict between “the pushing and progressive man of commerce eager to combine with other capitalists, “or other adventurers” and “the slow and conservative lawyer loth to see any changes in the somewhat elaborate machinery to which he “was used”, is followed from that period to the passing of the Companies Act of 1862, when the man of commerce appears to have gained a complete victory—a victory it may be said that has in no way damnified the man of law. The principal incidents connected with common law partnerships and the various advantages attaching

\* *The Companies Acts: A Course of Lectures.* By A. C. Clauson, Barrister-at-Law. Delivered at the Institute of Actuaries, Staple Inn Hall, during the Session 1898-99. London: C. & E. Layton, 56, Farringdon Street, E.C.



to incorporation are indicated and explained in a most interesting manner.

The second lecture deals with the formation of companies and contains also much valuable information regarding the Memorandum and Articles of Association, the limitation of liability, and the scope of the powers or objects of the company. The meaning of the word "capital" in connection with companies is carefully considered; the distinction between nominal, subscribed, and paid-up capital is defined, and it is pointed out that even paid-up capital is not always paid up in cash. It is unfortunate that this word "capital" should have attached to it so many different meanings. Leaving out of account its anatomical, political, and architectural significations, and confining our attention to economical and financial variations we find that in political economy "capital" is wealth employed reproductively; while Dr. Murray's dictionary has the following:—

Capital Stock or Fund. Commerce. The stock of a company, corporation, or individual with which they enter into business and on which profits or dividends are calculated; in a joint stock company it consists of the total sum of the contributions of the shareholders.

The stock-in-trade, or plant, or property of a company employed in the production of income is "capital" as defined by political economists; its value is often very much a matter of opinion, but a value of some sort must be put on it in order that it may appear amongst the assets in the company's balance sheet. On the other side of the balance sheet, amongst the liabilities, appears the "paid-up capital" of the company, which is clearly something very different from the capital included amongst the assets. It is, in fact, "the total sum of the contributions of the shareholders." If all shares have been paid for in cash, as is usual with insurance, banking, and similar companies, the identity is clear because the payments were made in sterling and the item in the balance sheet is similarly expressed. In the case, however, of industrial, mining, and other companies, where paid-up shares have been issued in consideration of the conveyance to the company of the good-will of a business, a factory and stock-in-trade, a mine, &c., a disturbing element is introduced, namely:—the value *in share capital* placed on the property so conveyed. In many such instances the paid-up capital expresses merely "the amount on which the profits or dividends are calculated." This is obviously the case also where the "paid-up capital" has been arbitrarily increased as has been done, to mention two recent examples, by the Midland Railway Co., and the Gas Light and Coke Co. We see then that to gauge the substantiality of a company we must look, not to the amount of the paid-up capital, but to the assets, and also to the liabilities ranking against the assets. It is perhaps hardly necessary to add that the best criterion of the value of the assets is usually their capacity to earn dividends.

Mr. Clauson treats the theory and practice of the limitation of liability very clearly, laying particular stress on the fact that a large majority of "limited liability" companies have their shares fully paid up, and are not therefore really "limited liability" companies at all



—the liability of the members is not limited, but *nil*. It is also shown that where the shares are not fully paid up the liability of the members is to the company and not to the creditors. The directors or liquidator can call up the amount unpaid and compel payment to the company, but creditors have no right of action against members.

The theory of this subject is well worthy of consideration. The law imposes no limit to the profits that may be derived by the members of a successful company, and it is perhaps at first sight not very obvious why the creditors of an unsuccessful company should lose the whole or part of the amount due to them in consequence of the limitation of the liability of the members. The arguments justifying the present state of the law are—firstly, that the creditors gave credit to the company knowing it to be "limited", and secondly, that it is a benefit to the community as a whole that joint stock enterprise should be encouraged by facilities enabling capitalists to embark a specific sum in an undertaking without risking the whole of their fortunes.

Lectures III, IV, and V comprise a discussion of the numerous points of detail that arise in the practical management and administration of companies. They are at least as instructive and useful as the other lectures although the matters dealt with are of less general interest. Yet Mr. Clauson has such an absolute mastery of his subject, and, to quote from the President's preface, "possesses such a happy combination of lucidity of style with simplicity of language" that the driest parts of his lectures are good reading. Attention may be called to the remarks on the powers of directors, especially regarding the danger of being guided in this matter solely by the articles of association, which do not, of course, override the law on the subject; and also to the description of debentures and debenture stocks. In discussing the nature of floating charges, Mr. Clauson says (p. 94), "Suppose that a drapery company has ten yards of valuable silk, and that all its assets are charged with the repayment of borrowed money. If the charge was an ordinary charge, any person to whom the silk is sold would receive the silk charged with the debt." Students would do well to read in connection with this *dictum* the paragraph in Strahan's Law of Property (p. 189) on "Sales in Market Overt."

It is perhaps worth mentioning that, although "shares in companies under the Companies Acts cannot be issued at a discount" (see p. 66), yet railway and other companies having special Acts of Parliament are sometimes empowered to issue ordinary shares or stock below par. A small slip appears to have been made on p. 73, where it is stated that the object of the provision in articles of association closing the transfer books during 14 days *preceding* the annual general meeting "is to stop transfers for a time so as to enable the officers of a company to make up the books and to send the proper returns to the Registrar of Joint Stock Companies, without having continual variations among the shareholders during the period in which they are making up the returns." As these returns have to be made up to the fourteenth day after the meeting, the transfers that have accumulated during the time the books were

closed are usually registered before the returns are completed. The closing of the transfer books prior to the meeting is for the convenience of making out the warrants for the dividend to be declared at the meeting; also if there is a contest of any kind to be decided, lists of voters and proxy holders can be more easily prepared while the books are closed. Possibly, however, "preceding" is a misprint for "following", as some companies close the books before and some after the meeting.

Lecture VI, after describing the various methods of winding up a company, deals with the kindred subject of reconstruction and concludes with a few observations on certain projected reforms in company law. The whole of this lecture is of great interest, but the parts that will naturally attract most attention are (1) the references to the Life Assurance Companies Acts and (2) the comments on the projected alterations of the law. The clauses of the Act of 1870 directing that contingent liabilities should be taken into account in investigating the solvency of a life office were looked on as an innovation; but the principle appears to have been extended by the decision in "*Hardy v. Fothergill*" to all companies and to all contingent claims; at all events, every claim must now, in a winding-up, be treated as capable of estimation.

The discussion of the "amalgamation" provisions of the Act of 1870 does not add much to the information already available in the pages of the *Journal of the Institute*, the subject having been fully dealt with towards the close of Mr. George King's well-known paper on "Legislation affecting Life Assurance Companies" (vol. xxix, p. 281). The suggestion made by Mr. Clauson that the word "amalgamation" is really a slang term will, however, bring joy to the heart of many a student of the Act who has never been able to fathom the mystery of these clauses. How can two "legal entities" be amalgamated? It would be as reasonable to propose the amalgamation of two human beings! The goodwill of a business with all liabilities and assets can be transferred from one company to another, or from two companies to a new company specially incorporated for the purpose, and this may involve the amalgamation of two bodies of policyholders for purposes of bonus distribution, &c., but the old company can and will exist after it has divested itself of all its property and liabilities, and will stand in need of the funeral rites of liquidator or registrar before it can be deemed to be dissolved, and finally vanish to that bourne from which no company returns.

There is a wide-spread feeling that the present state of the law of Joint Stock Companies is capable of improvement, and some projected reforms have already reached that stage of development which consists of the introduction into Parliament of Bills that are supposed to have some chance of getting passed some day. Mr. Clauson views these reforms somewhat from the standpoint of the "slow and conservative lawyer" described in his first lecture. Many of his remarks carry conviction with them, as for instance, "It often happens that an attempt to check an abuse checks, not the abuse, but legitimate business", and again, "The public often forget that they hear much more about the fraudulent concerns than about the

"genuine concerns." With the following sentiment, which it will be observed Mr. Clauson does not definitely adopt as his own, we must, however, join issue:—"There is, I think, a general feeling (in some parts of the commercial world at all events) that if people who are not familiar with these matters will insist on going into speculations, they should buy their experience, and they are not fairly entitled to claim protection of the Legislature if sometimes they fall into the hands of persons who are more astute than themselves." In the days of Dick Turpin a similar line of argument might have been put forward regarding reckless travellers who insisted on venturing on Hounslow Heath and sometimes fell into the hands of persons who were better armed than themselves. It is perhaps useless to look forward to the time when a company prospectus (and the particulars of a sale by auction) will be documents subject to that rule of *uberrima fides* now restricted to certain contracts of insurance but surely capable of beneficial extension. The most we can at present hope for is some improvement in the matters of audit, allotment on insufficient subscriptions, and minor points of the kind.

Mr. Clauson confesses that he has difficulty in seeing anything in "one man companies" that is "contrary to the principles of commercial morality." Surely these companies are merely colorable imitations of joint stock enterprises, and are not morally entitled to the privileges conferred by the Companies Acts. That they keep as a rule within the letter of the law must, we presume, be admitted; but where they come to grief and inflict loss on creditors, no pains should be spared to bring home to the "one man" any penalties that may have been incurred. Irregularities of even a trifling character should in these cases be punished with the utmost possible severity. It cannot be to the advantage of the community that an individual should be allowed to pose as a joint stock company to the detriment of others whose only fault is that they are less astute than they might be.

Mr. Clauson concludes by pointing out that the law covers a large field, and that he has been restricted to one corner of it. That it is a fertile corner and has under Mr. Clauson's skilful cultivation yielded an admirable crop of lectures, all who attended their delivery or who may peruse them in book form will, we are confident, heartily agree.

W. O. N.

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# THE LIFE ASSURANCE COMPANIES OF THE UNITED KINGDOM.

## Summary of the Life Assurance and Annuity Revenue Accounts.

[Extracted from the Parliamentary Return for 1898, published in 1899.]

INCOME	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£
Balance at the beginning of the Year . . . . .	214,127,439	15,437,518	229,564,957
Adjustment of Sun of India Balance . . . . .	-3,171	...	-3,171
	214,124,268	15,437,518	229,561,786
Premiums . . . . .	20,199,386	7,570,150	27,769,536
Consideration for Annuities . . . . .	1,985,892	1,635	1,987,527
Interest and Dividends (less Tax) . . . . .	8,198,530	523,361	8,721,891
Increase in value of Investments . . . . .	282,031	1,788	283,819
Fines, Fees, &c. . . . .	11,055	1,149	12,204
Capital Paid-up . . . . .	31,471	104,433	135,904
Customs Timber Measuring, &c. . . . .	4,076	...	4,076
Transfers from other Accounts . . . . .	4,696	48,014	52,710
Miscellaneous . . . . .	27,968	...	27,968
	244,869,373	23,688,048	268,557,421

OUTGO	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£
Claims . . . . .	13,176,900	2,912,046	16,088,946
Cash Bonuses and Reduction of Premiums . . . . .	1,028,396	288	1,028,684
Surrenders . . . . .	930,339	37,836	968,175
Annuities . . . . .	1,504,225	5,142	1,509,367
Commission . . . . .	1,155,352	1,952,399	3,107,751
Expenses of Management . . . . .	1,744,145	1,320,139	3,064,284
Bad Debts . . . . .	3,681	541	4,222
Decrease in value of Investments . . . . .	108,910	3,500	112,410
Interest on Capital and Dividends and Bonuses to Shareholders . . . . .	361,919	386,771	748,690
Transfers to other Accounts . . . . .	76,146	100,053	176,199
Capital withdrawn from Life Account (Sun Life) . . . . .	401,419	...	401,419
Miscellaneous . . . . .	5,486	...	5,486
Balance* at the end of the Year . . . . .	224,372,455	16,969,333	241,341,788
	244,869,373	23,688,048	268,557,421

\* This Balance includes the whole of the Life and Annuity Funds (£235,682,534), and, in addition, the Capital of Companies whose business is limited to Life Assurance only.

*Summary of the Balance Sheets (1898).*

LIABILITIES	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£
Paid-up Capital (including sundry Shareholders' Balances) . . .	11,327,962	1,451,815	12,779,777
Life and Annuity Funds . . .	219,835,806	15,846,728	235,682,534
Fire Funds of Companies trans-acting Life Business . . .	10,806,859	...	10,806,859
Marine Funds of Companies trans-acting Life Business . . .	645,832	...	645,832
Reserve Funds . . .	4,169,573	600,000	4,769,573
Other Funds . . .	1,025,101	194,149	1,219,250
Profit and Loss Balances . . .	4,341,513	...	4,341,513
Depreciation and Investment Balances . . .	1,157,091	18,820	1,175,911
Globe Annuitants (Liverpool and London) . . .	1,102,800	...	1,102,800
Outstanding Claims . . .	3,847,017	39,576	3,886,593
Outstanding Accounts . . .	569,978	6,905	576,883
Temporary Loans . . .	13,188	...	13,188
	258,842,720	18,157,993	277,000,713
ASSETS	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£
Mortgages . . .	80,649,419	1,523,694	82,173,113
Loans on Policies . . .	11,306,750	39,656	11,346,406
„ Rates . . .	22,983,343	6,152,802	29,136,145
British Government Securities . .	4,764,626	1,642,642	6,407,268
Indian and Colonial Government Securities . . .	17,839,031	345,658	18,184,689
Foreign Government Securities . .	7,577,700	339,844	7,917,544
Debentures . . .	43,542,265	1,797,703	45,339,968
Shares and Stocks . . .	28,717,297	75,127	28,792,424
Companies' own Shares . . .	641,892	...	641,892
Land and House Property and Ground Rents . . .	18,828,573	4,792,502	23,621,075
Life Interests and Reversions . .	5,933,184	2,019	5,935,203
Loans on Personal Security . . .	1,588,553	5,740	1,594,293
Agents' Balances and Outstanding Premiums . . .	5,364,900	508,671	5,873,571
Outstanding Interest . . .	2,374,051	167,924	2,541,975
Cash, Deposits, Stamps, &c. . .	6,498,909	356,139	6,855,048
Customs Timber Measuring Balances, &c. . .	4,709	...	4,709
Deficiencies, Preliminary Expenses, &c. . .	227,518	407,872	635,390
	258,842,720	18,157,993	277,000,713



INCREASE (+) or DECREASE (—) in the Chief Items of this Year's SUMMARY as compared with the corresponding Items for the previous Year.

	Ordinary Companies	Industrial Companies
<b>INCOME.</b>		
	£	£
Premiums . . . . .	+ 594,638	+ 419,041
Consideration for Annuities . . . . .	— 344,489	— 4,099
Interest and Dividends (less Tax) . . . . .	+ 233,769	+ 43,097
Net Result of Realization and Re-valuation of Investments . . . . .	+ 34,231	+ 223
<b>OUTGO.</b>		
Claims . . . . .	— 15,029	+ 160,816
Annuities . . . . .	+ 126,406	+ 409
Surrenders . . . . .	— 63,058	+ 10,134
Commission . . . . .	+ 40,238	+ 71,737
Expenses of Management . . . . .	+ 18,835	+ 40,895
<b>LIABILITIES.</b>		
Paid-up Capital (including sundry Shareholders' Balances) . . . . .	+ 204,212	+ 104,728
Life and Annuity Funds . . . . .	+ 10,614,304	+ 1,442,457
<b>ASSETS.</b>		
Mortgages (including Loans on Rates) . . . . .	+ 22,557	+ 330,740
Life Interests and Reversions . . . . .	+ 465,074	+ 1,661
Loans on Policies . . . . .	+ 335,563	— 2,143
British Government Securities . . . . .	— 117,513	+ 329,972
Indian and Colonial Government Securities . . . . .	+ 760,360	+ 41,656
Foreign Government Securities . . . . .	+ 750,691	+ 216,435
Debentures . . . . .	+ 4,434,086	+ 3,598
Shares and Stocks . . . . .	+ 3,602,039	+ 45,038
Companies' own Shares . . . . .	— 1,098	...
Land and House Property and Ground Rents . . . . .	+ 1,108,737	+ 494,147
Loans on Personal Security . . . . .	+ 23,538	+ 503

#### NUMBER OF COMPANIES.

The total number of Companies appearing in the above Summary is 92, of which 81 have been classed as Ordinary, 7 as Industrial, and 4 appear in both Classes, the Returns of these Companies showing the Ordinary and Industrial business separately. The Returns of the "British Life" and the "Vulcan" are included for the first time.

During the year four names have been removed from the official List of Companies, namely, the Employers' Indemnity, where the deposit was returned, the Memorandum of Association excluding Life Business; Perseverance, which did not register as a Life Company; Reliance, and Sun of India, in which cases the business was transferred. And three names have been added, namely, Life and Health Assurance Association, Limited; Old Age Pension and Life Assurance, Limited; and Wool Industries Employers' Insurance Association; in which cases the Board of Trade have issued their warrant under the provisions of Section 1 of "The Life Assurance Companies Act, 1872."



SUMMARY OF THE ASSURANCES IN FORCE, as shown by the last Returns of the Companies.  
ORDINARY BUSINESS.

	WITH PROFITS		WITHOUT PROFITS		TOTAL		Re-assur- ances — Amount	Net Amount
	No.	Amount	No.	Amount	No.	Amount		
ASSURANCES.		£		£		£	£	£
Whole Term of Life	766,164	369,485,412	138,516	68,369,456	904,680	437,854,868	23,844,922	414,009,946
Limited number of Premiums . . .	41,283	24,770,291	7,137	3,304,882	48,420	28,075,173	1,158,013	26,917,160
	807,447	394,255,703	145,653	71,674,338	953,100	465,930,041	25,002,935	440,927,106
Endowments . . .	2,034	424,039	17,134	4,153,850	19,168	4,577,889	10,500	4,567,389
Endowment Assur- ances . . .	648,169	109,338,088	44,483	13,950,587	692,652	123,288,675	1,723,639	121,565,036
Joint Lives . . .	15,539	3,224,852	2,605	1,135,095	18,144	4,359,947	388,982	3,970,965
Last Survivor . . .	960	775,836	1,118	1,394,887	2,078	2,170,723	362,285	1,808,438
Contingent . . .	17	22,568	3,804	5,665,910	3,821	5,688,478	1,411,677	4,276,801
Issue . . .	4	13,500	1,121	4,373,948	1,125	4,387,448	1,265,817	3,121,631
Miscellaneous . . .	1,332	1,092,243	6,623	8,260,552	7,955	9,352,795	1,682,345	7,670,450
	1,475,502	509,146,829	222,541	110,609,167	1,698,043	619,755,996	31,848,180	587,907,816
ANNUITIES.								
Immediate . . .	...	...	...	...	27,436	1,396,370	41,329	1,355,041
Deferred . . .	...	...	...	...	9,755	284,168	15,173	268,995
	...	...	...	...	37,191	1,680,538	56,502	1,624,036

INDUSTRIAL BUSINESS—(Sickness and Friendly Society Contracts not included).

	WITH PROFITS		WITHOUT PROFITS		TOTAL		Re-assur- ances — Amount	Net Amount
	No.	Amount	No.	Amount	No.	Amount		
ASSURANCES.						£	£	£
Whole Term of Life	...	...	...	...	15,930,785	152,782,644	1,000	152,781,644
Limited number of Premiums . . .	...	...	...	...	703	12,534	500	12,034
	...	...	...	...	15,931,488	152,795,178	1,500	152,793,678
Endowments . . .	...	...	...	...	804,651	6,245,955	...	6,245,955
Endowment Assur- ances . . .	...	...	...	...	182,202	1,947,840	88	1,947,752
Joint Lives . . .	...	...	...	...	312,326	4,998,833	...	4,998,833
Contingent . . .	...	...	...	...	4	1,910	400	1,510
Miscellaneous . . .	...	...	...	...	41	765	...	765
	...	...	...	...	17,230,712	165,990,481	1,988	165,988,493
ANNUITIES.								
Immediate . . .	...	...	...	...	63	3,185	...	3,185
Deferred . . .	...	...	...	...	2	123	...	123
	...	...	...	...	65	3,308	...	3,308

The above figures are based on Returns deposited, for the most part, during the last five years, and are, therefore, merely an approximation to the amount of contracts in force at the present time. In the case of two Companies, namely, the Customs Fund and the Northern, the amount of business at a more recent date has been included. The figures of the Colonial and Foreign Companies have been excluded, as their Returns do not separately show the extent of business in the United Kingdom.

## THE INSTITUTE OF ACTUARIES.

## EXAMINATIONS OF THE INSTITUTE, APRIL 1899.

EXAMINATION FOR ADMISSION TO THE CLASS OF ASSOCIATE  
(PART I).*Examiner*—PROF. S. L. LONEY, M.A.*Supervisors*—MESSRS. W. HUGHES and F. E. COLENZO, M.A.*First Paper.*

1. A man sold out from a Stock, paying  $2\frac{3}{4}$  per-cent per annum, at  $96\frac{1}{4}$ , and invested the proceeds in another Stock, paying 4 per-cent. If thereby he raises his income 5 per-cent, find the price of the second Stock.

2. Find the L.C.M. and H.C.F. of  $x^6+1$  and  $x^8+x^4+1$ .  
Simplify the expression

$$\frac{x^3-x-6}{x^2+2x+3} \times \frac{x^2+2x+6}{x^3+2x-12}.$$

3. Solve the equations

$$(1) \quad \frac{x+3}{x+4} - \frac{x+4}{x+5} = \frac{x+5}{x+6} - \frac{x+6}{x+7};$$

$$(2) \quad \sqrt{x^2+2x-4} + 2x^2 = 18-4x.$$

4. If A, G, and H be the arithmetic, geometric, and harmonic means between two positive quantities  $a$  and  $b$ , prove that A, G, H are in geometrical progression and in descending order of magnitude.

Insert 6 arithmetic means between 7 and 12.

5. Three numbers in Geometrical Progression have a product equal to 64. If a certain number be added to each the sum of the results and the sum of their squares are 20 and 152 respectively. Find all four numbers.

6. Find the number of permutations of  $n$  things taken  $r$  at a time, and hence deduce the number of combinations.

In a railway carriage, which seats 5 on each side, there are 10 people. Of these 3 wish to travel with their backs to the engine, and 2 refuse to do this. In how many ways can they be arranged?

7. Find the present value of £P due at the end of  $n$  years, compound interest being reckoned at the rate of £ $r$  per unit per annum. What does this formula become if the interest be convertible half-yearly?

A man is entitled in 20 years' time to receive £10,000; allowing interest at 4 per-cent, what is the present value of this right

to the nearest penny? Given  $\log 1.04 = .0170333$ ,  $\log 4.5638 = .6593266$ , and  $\log 4.5639 = .6593361$ .

8. Assuming the truth of the expansion of  $a^x$ , deduce the Logarithmic series:

$$\log(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \dots \text{ad inf.}$$

Are there any limitations to the value of  $x$ ?

Prove that

$$\begin{aligned} \log x - \frac{1}{2} \log(x+1) - \frac{1}{2} \log(x-1) \\ = \frac{1}{2x^2-1} + \frac{1}{3} \left( \frac{1}{2x^2-1} \right)^3 + \frac{1}{5} \left( \frac{1}{2x^2-1} \right)^5 + \dots \end{aligned}$$

9. If the speed on a railway be 20 miles an hour, it is found that the expenses are just paid. If the speed be more than 20 miles an hour the increase of the receipts is found to vary as the increase of the velocity, and the increase of the cost of working to vary as the square of the increase of the velocity; at the rate of 40 miles an hour the expenses are just paid; find the velocity at which the profits are greatest.

10. Find the  $n$ th term, and the sum of  $n$  terms, of the recurring series

$$6 + 31x + 145x^2 + 643x^3 + \dots$$

11. Explain how the probability of the happening of an event is estimated mathematically.

Two persons, A and B, play a match at a certain game, the winner being the one who first wins two consecutive games, no game being drawn. Their chances of winning any particular game are as  $a:b$ . Show that A's initial chance of winning is  $\frac{a+2b}{a+b} \cdot \frac{a^2}{a^2+ab+b^2}$ . If A wins the first game, prove that his chance of winning is then increased to  $\frac{a(a+b)}{a^2+ab+b^2}$ .

12. If a straight line be divided into two equal and also into two unequal parts, the rectangle contained by the unequal parts, together with the square on the line between the points of section, is equal to the square on half the line.

Divide a given straight line into two parts such that the rectangle contained by them may be the greatest possible.

### *Second Paper.*

1. An Assurance Company lends £5,050 to a Local Board, which is to be repaid by three yearly instalments of £1,802. 10s. 4d., including interest at  $3\frac{1}{2}$  per-cent per annum. What entries in the Company's books are necessary? Trace the transaction by annual entries to its conclusion, assuming punctual payment of the instalments.

2. A tradesman's marked price is 25 per-cent above the cost price of his goods, but he takes 10 per-cent off his bills for cash payment: what rate per-cent profit does he make, and what must be his marked price if he wishes to make 15 per-cent profit?

3. Prove that a quadratic equation can only have two roots, and find the relations between (1) the sum, and (2) the product of the roots of the equation  $ax^2+bx+c=0$  and the coefficients  $a, b, c$ .

In the same equation, find the values of  $\alpha^3-\beta^3$  and  $\frac{1}{\alpha^3} + \frac{1}{\beta^3}$ .

4. Solve the equations

$$\begin{aligned}x+y+z &= a, \\x^2+y^2+z^2 &= 3a^2, \\xy+yz &= 0.\end{aligned}$$

5. Prove the truth of the Binomial Theorem for a positive integral exponent.

Neglecting cubes and higher powers of  $x$ , prove that

$$\frac{(a+x)^n}{(b-x)^n} = \frac{a^n}{b^n} \left[ 1 + nx \frac{a+b}{ab} + \frac{nx^2(a+b)}{2a^2b^2} \{ n(a+b) + (a-b) \} \right].$$

6. Find the sum to  $n$  terms of the series;

$$(1) \quad 1^3+2^3+3^3+4^3+\dots$$

$$(2) \quad \text{whose } n\text{th term is } \frac{n(n-1)-2nx+x^2}{(n-x)(n-1-x)}.$$

7. Find the value of an annuity of £ $P$  per annum to continue for  $q$  years, the first payment to be made at the end of  $p$  years from the present time, and compound interest being reckoned at £ $r$  per unit per annum.

The full rent of a farm is £200 per annum, and a farmer bought a lease of it for 15 years at a rent of £100 payable annually. After 6 years of the lease had expired, he buys the freehold of the farm. Taking the rate of interest as 4 per-cent, find the amount he should pay, to the nearest £.  $[(1.04)^{-9}=.70259]$ .

8. A company issues 5 per-cent debenture bonds to the amount of £1,000,000. It sets aside a certain sum each half year to pay the interest on the bonds and to gradually redeem them by half-yearly drawings at par in the course of 50 years. Find the sum that must be put aside each half year, given  $\log 1.025=.0107239$  and  $\log 8.4647=.92761$ .

9. Prove that the product of any  $n$  successive integers is always divisible by  $n$ .

If  $n$  is an integer, prove that  $\frac{n^5}{120} - \frac{n^3}{24} + \frac{n}{30}$  is also an integer.

10. The chances of an event happening in one trial being  $p$ , find the chance of its happening exactly  $r$  times in  $n$  trials.

Three dice with faces marked 1 to 6 were thrown, and the sum of the numbers cast was 12. Find the chance that the number shown by each die was 4.

11. A bag contains 10 balls of which 6 are known to be red, and of the rest each is equally likely to be red or white. Three balls are drawn, found to be red, and replaced, and then a white ball is drawn: what is the chance that there are at least two more white balls in the bag?

12. If a straight line touch a circle and from the point of contact any chord be drawn, the angles which this chord makes with the tangent are equal to the angles in the alternate segments of the circle.

If a tangent to a circle be parallel to a chord, the point of contact of the tangent is the middle part of the arc cut off by the chord.

### EXAMINATION FOR ADMISSION TO THE CLASS OF ASSOCIATE (PART II).

*Examiners*—MESSRS. J. E. FAULKES, L. F. HOVIL, A. D. BESANT, B.A.,  
and J. D. WATSON.

#### *First Paper.*

1. Find a formula for the present value of an annuity-certain where the accumulative rate differs from the remunerative rate. A loan of £1,000 is to be repaid by an annuity (payable yearly) over 5 years; the lender makes it a condition that the transaction shall throughout pay him 6 per-cent, and he also wishes to provide for the fact that he can re-invest at 4 per-cent only. Find the amount of the annual charge, and draw up a table showing the mode in which each annuity payment should be allocated in the books of the lender.

*N.B.—A logarithm card will be provided.*

2. A system of free education is introduced into a community embracing all children from the age of 5 to 13 inclusive. The present number of such children is  $A$ , but the birth rate in the community, previously stationary, has been increasing during the last four years at 1 per-cent per annum. What would you estimate to be the number of children under education at the end of 20 years, and how many children will have passed out during the period?

3. Give three formulæ for  $P_x$  in terms of  $a_x$ ,  $A_x$ , and  $d$ , and discuss their verbal interpretations.

4. Prove that the value of a temporary annuity for  $n$  years, payable half-yearly to a life aged  $x$ , is approximately  $\frac{1}{2}[3a_{x\overline{n}} + a_{x\overline{n}}]$ .



5. Under a deed of separation, A covenants to pay an annuity of £ $k$  per annum to his wife B so long as she lives, and the terms of the deed make his estate liable for the annuity after his death. He wishes to free his estate from this liability so long as his daughter C survives him, and applies to an insurance company for a quotation for the annual premium for such a contingent annuity. Deduce a formula for the net annual premium to be charged.

6. Find the net level annual premium for a whole-life assurance commencing at 1 and increasing  $k$  per annum. What is the value of such a policy  $t$  years after issue?

7. You are asked to investigate the mortality experience of a life office. Mention the various methods in which this may be done, and describe in detail the method you would adopt.

8. Show how to calculate according to the H<sup>M</sup> Table the annual premium for a Joint-Life Endowment Assurance, and discuss any approximations to the true method with which you may be acquainted.

9. Application is made to convert a non-profit whole-life policy into an endowment assurance. What methods would you suggest for quoting terms for this? Would the duration of the original contract influence you in deciding what method to adopt?

10. Discuss fully the question of insurable interest in connection with life assurance policies.

11. Under what circumstances do you consider that a mortgagee of a life policy—(a) legal, (b) equitable—can (1) give a valid receipt for the claim payable under the policy, (2) give a valid discharge of the policy on surrender?

12. Criticise the following as investments for a life office, mentioning any points that may occur to you against them or in their favour—(a) Freehold and Leasehold Ground Rents, (b) American Railroad Bonds (Gold, Sterling and Currency), (c) Debentures of Trust Companies, (d) Loans on Personal Security.

### *Second Paper.*

1. Investigate a formula for ascertaining the rate of interest yielded by a terminable debenture bond redeemable at a premium. What price would you pay, to allow a return of 4 per-cent on your investment, for an American Railroad Gold Bond for \$500 repayable at the expiration of 4 years at par, interest on which at 5 per-cent is payable half-yearly, interest and principal both being payable in London at the fixed rate of exchange of 4s. 1½d. per \$1?

*N.B.—A logarithm card will be provided.*

2. State fully how you would construct a table of net annual premiums for sinking fund policies at 2½ per-cent interest, no interest tables being available.

3. An office at the beginning of a year has  $m$  policies on its books on the lives of as many persons all aged  $x$ . Obtain from first principles formulæ giving (1) The most probable number of claims; (2) The expected claims.

4. Deduce the formula

$$A_{xy}^1 = \frac{1}{2} \left( A_{xy} + \frac{a_{x-1:y}}{p_{x-1}} - \frac{a_{x:y-1}}{p_{y-1}} \right)$$

and show what this becomes when dealing with select lives.

5. Find expressions for the single and annual premiums for an annuity to commence on the death of ( $y$ ) and continue payable during the remainder of the life of ( $x$ ), but to be payable only if ( $y$ ) dies within  $t$  years.

6. What do you understand by Commutation Columns? Show the connection between the assurance and annuity columns.

Investigate a formula in commutation symbols for the purchase-money of a term annuity for  $n$  years on a life aged  $x$  at entry, the annuity to be payable quarterly and apportionable to day of death, select mortality tables being used and the D and II columns only being available.

7. Give formulæ showing the value of a policy by the Prospective, Retrospective, and Hypothetical (or Re-assurance) Methods. Explain by general reasoning the principles underlying each method.

8. Obtain expressions for the values of  $M_{xy}^1$  in Commutation symbols, distinguishing between the cases when  $x > y$  and  $x < y$ , and show how the formulæ vary according to the adoption of Davies' or De Morgan's form of obtaining  $D_{xy}$ .

9. How would you calculate the single premium for an option to effect an insurance  $n$  years hence at the ordinary annual premium upon a select life now aged  $x$  if he be then alive?

10. Find the net premium limited to 10 payments for an assurance on a life aged  $x$  under which the sum assured is unity until all the premiums are paid up, thereafter the sum assured is the amount of the premiums accumulated at compound interest at rate  $i$  from the date of payment of each premium until the end of the year of death should death happen before the expiration of the 20th year of assurance. In the event of the life surviving the 20 years the sum assured again becomes unity, but the policyholder is to be entitled to an annuity of  $i$  per-cent per annum upon the total amount of the premiums actually paid (without interest) until death.

11. A voluntary settlement of a life-policy (the settlor being the life assured) comes before you at the present time in connection

with (a) the surrender of (b) an application for a loan on (c) a claim under the policy which has been subject to no other dealings. What would be your course of procedure, taking the deed as dated (1) in 1887 (2) in 1895 (3) in 1898?

12. State with reasons (a) the particulars for which you would ask in connection with an application for an advance upon mortgage of a freehold landed estate, (b) the points to which you would refer in considering the prospectus of a new debenture issue of a trading company—in order to judge of the suitability of the loan or investment for a life office.

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EXAMINATION FOR ADMISSION TO THE CLASS OF FELLOW  
(PART III, SECTION A).

*Examiners*—MESSRS. G. H. RYAN, J. CHISHOLM, H. W. ANDRAS,  
L. M. SIMON, W. P. PHELPS, M.A., and E. A. RUSHER.

*First Paper.*

1. Discuss the National Debt, the Local Debts of the United Kingdom, and the several Colonial Debts, with special reference to the purposes for which they have been raised and the security for the fulfilment of the several obligations.

2. State the circumstances under which a Life Office can avail itself of the power conferred by "The Life Assurance Companies (Payment into Court) Act, 1896."

3. Describe the process of amalgamation of two Life Offices in accordance with the provisions of the Life Assurance Companies Acts, both in the case of mutual and proprietary Offices.

4. Enumerate and briefly describe the various Death Duties existing prior to "The Finance Act, 1894." What were the principal changes effected by that Act?

5. Describe what is meant by foreclosure, and the manner in which it is effected.

6. Explain fully the risks that a lender runs by advancing money on second mortgage, and what steps should be taken to guard against these risks.

7. Define what is meant by the following terms:

Estate in fee simple.

Tenant for life.

Tenant in tail.

Vested remainder.

Contingent remainder.

Base fee.

8. What are the advantages and disadvantages to a joint stock company of raising money by ordinary mortgage or by the issue of debentures respectively?

9. Enumerate the various elements that determine the price of foreign bills; and show how a rising rate of exchange is held in check by arbitrage operations in stocks.

10. Discuss the adequacy of the gold reserve held by the Bank of England. Would you advocate the holding of larger gold reserves by Banks generally? Give reasons for your answer. Under what conditions is the Bank of England said to borrow from the market?

11. What are the fundamental differences between a bill of exchange, a cheque, and a promissory note?

12. Discuss the effect to India of the Indian Government borrowing in the Indian and English markets respectively.

### *Second Paper.*

13. What information would you require, and in what form, in order to deduce the experience of a Friendly Society granting sick pay at full benefit for the first six months, half benefit for the second six months, and quarter benefit afterwards, and making payments on the deaths of members and their wives?

14. In obtaining a mortality table from two census returns and the record of births and deaths for the intervening years, show fully how you would deal with the first five years from birth.

15. Given the object of graduation to be the preparation of a table, in one case to form a basis for numerous rates of premium, and in another case to exhibit the mortality experience of a special class of lives, what methods of graduation would you adopt respectively, and why? What tests would you apply to the results obtained by any graduation?

16. In deducing a Mortality Table from the experience of a large Life Assurance Company, it has been decided to follow the data through "policy years"; state briefly the methods of collating the facts known as:

- (1) the exact duration method,
- (2) the mean duration method,
- (3) the nearest duration method.

Which method do you prefer? Give your reasons.

17. Describe briefly the methods used in the graduation of the following tables:

The Healthy Males Institute of Actuaries' Table.

The Government Annuitants (1884) Tables.

What improvements have been suggested in the methods adopted?

18. State the nature and scope of the sickness and mortality experience statistics and monetary tables based thereon, contained in Mr. Sutton's Special Report on Friendly Societies (1896).

In what respects are they more satisfactory for use in Friendly Society calculations than the Manchester Unity (1866-70) Tables?

19. What tables would you be guided by, and what considerations would influence you, in advising on the rate of extra premium to be charged by a Life Assurance Company for residence in India?

20. Discuss fully the Method of Final Series as employed in the preparation of the 30 American Offices Experience Tables.

21. Prove that

$$\Delta^n 0^m + m \Delta^n 0^{m-1} + \frac{m(m-1)}{1.2} \Delta^n 0^{m-2} + \dots + \frac{m}{m-n} = \frac{\Delta^{n+1} 0^{m+1}}{n+1}.$$

22. Prove that

$$u_0 + u_1 x + \frac{u_2 x^2}{1.2} + \dots = \epsilon^x \left\{ u_0 + x \Delta u_0 + \frac{x^2 \Delta^2 u_0}{1.2} + \dots \right\},$$

and show how to apply the formula to calculate the value of a decreasing life annuity, the payments at the end of the 1st, 2nd, 3rd, 4th, &c., years being  $1, \frac{1}{2}, \frac{1}{6}, \frac{1}{24},$  &c., respectively.

23. Apply Lagrange's theorem of interpolation to obtain the value of  $a_{50}$ , having given that

$$a_{35} = 18.587,$$

$$a_{40} = 17.176,$$

$$a_{60} = 10.236.$$

24. Given that the expansion of  $\frac{x}{(1+x)^n - 1}$  in powers of  $x$  is

$$n + \frac{n-1}{2}x - \frac{n^2-1}{12n}x^2 + \frac{n^2-1}{24n}x^3 - \frac{(n^2-1)(19n^2-1)}{720n^3}x^4 + \dots$$

prove that

$$\begin{aligned} & u_0 + u_t + u_{2t} + \dots + u_{(n-1)t} \\ &= n u_0 + \frac{n-1}{2} \Delta u_0 - \frac{n^2-1}{12n} \Delta^2 u_0 + \frac{n^2-1}{24n} \Delta^3 u_0 - \frac{(n^2-1)(19n^2-1)}{720n^3} \Delta^4 u_0 + \dots \end{aligned}$$

Transform the identity into one from which an approximate value of  $a_{50.70}$  may be readily obtained from the values of  $D_{50.70}$ ,  $D_{58.78}$ ,  $D_{66.86}$ , and  $D_{74.94}$ .



EXAMINATION FOR ADMISSION TO THE CLASS OF FELLOW  
(PART III, SECTION B).

*Examiners*—MESSRS. G. H. RYAN, J. CHISHOLM, H. W. ANDRAS,  
L. M. SIMON, W. P. PHELPS, M.A., and E. A. RUSHER.

*First Paper.*

1. How would you estimate the liability of a fund in respect of pensions for life to any widow each member of the fund, whether a married man, a widower, or a bachelor at the time of valuation, might leave; or, in default of there being a widow, to children in equal shares until the attainment of 21, or, in the case of females, earlier marriage?

2. How would you detect and eliminate negative values? Under what circumstances are they generally met with?

3. Explain Woolhouse's approximate method of valuation. For what purposes would you make use of it, and how would you modify it to meet the case of endowment assurances?

4. An Office has upon its books a large number of endowment assurance policies at half-yearly and quarterly premiums. Explain how you would value such policies, distinguishing between those originally granted for a fixed number of years and those maturing at definite ages.

5. It is proposed to change the basis of the valuation of a Life Assurance Company from  $H^M$  3 per-cent to  $H^M$   $2\frac{1}{2}$  per-cent: the Company earns an average rate of interest of  $3\frac{1}{2}$  per-cent and divides its surplus on the uniform reversionary bonus system. Draft a brief report to the Directors indicating the probable effect upon reserves and bonuses.

6. An Office transacts an increasing new business, and makes an annual valuation by the  $H^M$  Table with interest at 3 per-cent. How would you (a) obtain and (b) allot the profit from

- i. Interest,
- ii. Mortality.

The premiums charged by the Office are based upon the  $H^M$  3 per-cent table with a percentage loading.

7. State your opinion as to the comparative advantages of the net premium and gross premium methods of valuation. What gross premium methods, or modifications thereof, in actual use are you acquainted with?

8. Discuss on general grounds the question whether any limit should be set to the amount of new (whole-life and endowment assurance) business transacted by a Life Office making a net premium valuation at  $2\frac{1}{2}$  per-cent interest.

9. Draft a report from the Actuary to the Board of a Life Office bringing out the salient features of the quinquennial valuation just completed, and of the general statistical experience of the Office during that period.

10. It is desired to ascertain whether the extra mortality experienced by a Life Office among lives in military and naval service and others exposed to the risks of unhealthy climates has been covered by the premiums charged. How would you investigate the subject?

11. Discuss the principles which would guide you in determining the maximum amount to be retained by a company at its own risk on a single life.

12. How would you allow for "Selection" in framing a table of surrender values of whole life and endowment assurance policies?

### *Second Paper.*

13. In buying reversions where the funds consist of stocks or debentures standing at a premium and redeemable at par, and leasehold house property, what precautions would you observe in estimating their value?

14. What particulars would you require, and what precautions would you take, in connection with an offer for sale of

- (a) a life interest,
- (b) a contingent reversion,
- (c) an absolute reversion,
- (d) a policy effected in another Company?

15. What is the market value of the reversion to the following fund expectant on the death of a female aged 75, provided a male aged 30 survive her?

1. £200 per annum Borough of Birmingham (perpetual) Annuities.
2. £50 per annum Freehold Ground Rents.
3. £2,000 India  $3\frac{1}{2}$  per-cent Stock.
4. £5,000 Cape of Good Hope 4 per-cent Stock.
5. A house held on lease for 27 years unexpired, at a ground rent of £40 per annum, the rack rent of which is £300 per annum.

16. A is entitled absolutely to the reversion to  $\frac{3}{8}$ ths of a landed estate, valued at £100,000, on the death of B, a female aged 71, and to the reversion to another  $\frac{3}{8}$ ths of the same estate on the death of C, a female aged 74. A is also tenant in tail of the remaining  $\frac{1}{4}$ th of the estate, the tenant for life, D, being a male aged 76.

Value A's maximum interest in the estate, and state what amount you would lend on its security and for what term of years you would allow the loan to accumulate at  $4\frac{1}{2}$  per-cent interest. A's issue numbers 12 healthy persons, aged from 5 to 23.

17. A, a male aged 30, is entitled to the reversion to the fee simple of a certain estate valued at £200,000, provided he survive the life tenant B, a male aged 54, subject to the following charges:

1. Provision in favour of younger children £15,000.
2. Jointures of £1,200 a year to C, a female aged 78, and of £1,500 a year to D, a female aged 57, to be increased to £2,000 a year on the death of C.

Value A's interest, assuming his life to be assurable at the ordinary rate.

18. What several plans are adopted for valuing reversions and life interests for the balance sheet of a Life Office, and of dealing with these securities in the annual accounts?

19. Write down a formula for obtaining the single premium for an assurance payable on the death of the last survivor of four male lives, aged 41, 43, 45, and 47, provided a female life, aged 75, is living at the death of such survivor. Explain how you would apply the formula practically.

20. It is required to make provision for an assurance to be granted at the end of  $n$  years on a healthy life now aged  $x$  without further evidence of health. How would you assess the fine or single payment to be charged at the present time for such deferred assurance, assuming the annual premium payable, when the risk commences, to be the normal rate for age  $x+n$ . Do such fines increase with  $n$ ?

21. Prove the formula of approximate summation,

$$\int_0^{\omega} u_x dx = \frac{1}{m} \left( u_0 + u_{\frac{1}{m}} + u_{\frac{2}{m}} + \dots + u_{\omega} \right) - \frac{1}{2m} (u_0 - u_{\omega}) + \frac{1}{12m^2} \left( \frac{du_0}{dx} - \frac{du_{\omega}}{dx} \right) - \dots \&c.,$$

and deduce the value of  $a_x^{(m)}$  in terms of  $a_x$ .

22. Express the following benefits in the form of integrals:

$$\bar{A}_{xyz}; \quad \bar{a}_{yzx}^1; \quad \bar{a}_{xyz|w}^3.$$

23. If B is the value of any benefit of unity payable at the end of the year in which any event, certain or contingent, may happen; and (IB) is the value of a similar benefit increasing by unity each successive year; prove that

$$(IB) = -(1+i) \frac{dB}{di} \\ = -(1+i) \frac{1}{m} \left[ \Delta B - \frac{1}{2} \Delta^2 B + \frac{1}{3} \Delta^3 B - \frac{1}{4} \Delta^4 B + \dots \right],$$

where  $m$  is the interval in respect of which the differences are taken.

If the office premium is 15 per-cent greater than the net premium, find the approximate value, at  $3\frac{1}{2}$  per-cent, of the annual office premium for an endowment assurance on a life aged 40, to be payable at age 60 or previous death, all Office premiums to be

returned without interest in the event of death before age 60, having given

$$3\% \quad A_{40:\overline{20}|}^1 = .20413$$

$$3\frac{1}{2}\% \quad A_{40:\overline{20}|}^1 = .19385 \quad A_{40:\overline{20}|} = .55338 \quad 1 + {}_{19}a_{40} = 13.207$$

$$4\% \quad A_{40:\overline{20}|}^1 = .18428$$

$$4\frac{1}{2}\% \quad A_{40:\overline{20}|}^1 = .17536$$

24. Evaluate the following :

$$1. \quad \int x \log x \, dx ;$$

$$2. \quad \int \frac{x^3 dx}{\sqrt{1-x^2}} ;$$

$$3. \quad \int \frac{(x-1)dx}{(x-3)(x+2)} .$$

#### PROCEEDINGS OF THE INSTITUTE.—SESSION 1898-99.

##### *First Ordinary Meeting, 28 November 1898.*

The first ordinary meeting of the session 1898-99 was held at the Hall of the Institute, on the 28th day of November 1898.

The President (Mr. H. W. MANLY) in the Chair.

The President delivered an inaugural address.

##### *Second Ordinary Meeting, 19 December 1898.*

The President (Mr. H. W. MANLY) in the Chair.

The following gentlemen were duly elected:—Mr. Edward Thomas Joseph Blount, F.F.A., as Associate, and Messrs. Léon Duboisdeghien, David Parks Fackler, Fl. Hankar, Johannes Karup, and Dr. Grosse, as Corresponding Members.

A paper entitled “Debentures of Trading Companies as Investments for Life Assurance Funds, considered in their Legal and Financial Aspects”, was read by the author, Mr. A. R. Barrand.

The following gentlemen took part in the discussion:—Messrs. W. Hughes, Geoffrey Marks, J. E. Faulks, J. R. Hart, J. Burn, J. B. Tennant, and the President.

##### *Third Ordinary Meeting, 30 January 1899.*

The President (Mr. H. W. MANLY) in the Chair.

A paper entitled “Some Considerations in reference to the Fall in the Rate of Interest experienced in the Past, and the Probability of its Continuance”, was read by the author, Mr. J. Burn.

The following gentlemen took part in the discussion:—Messrs. J. Sorley, Alex. J. Finlaison, C.B., A. G. Mackenzie, A. H. Bailey, and the President.

*Fourth Ordinary Meeting, 27 February 1899.*

The President (Mr. H. W. MANLY) in the Chair.

Mr. George Macritchie Low, F.F.A., was duly elected a Fellow.

A paper entitled "Some Notes on Life Assurance in Greater Britain, particularly with reference to the Work and Development of the Native Offices", was read by the author, Mr. A. W. Tarn.

The following gentlemen took part in the discussion:—Messrs. C. D. Higham, James Chisholm, and the President.

*Fifth Ordinary Meeting, 27 March 1899.*

The President (Mr. H. W. MANLY) in the Chair.

A paper entitled "Some Notes on Sinking Fund Assurances" was read by the author, Mr. J. E. Faulks, B.A.

The following gentlemen took part in the discussion:—Messrs. G. S. Crisford, L. F. Hovil, S. G. Warner, Geo. Todd, W. P. Pulley, Geoffrey Marks, and the President.

*Sixth Ordinary Meeting, 24 April 1899.*

The President (Mr. H. W. MANLY) in the Chair.

The President announced that Mr. James Meikle had presented to the Institute a replica of a statue erected in Edinburgh by Fellows of the Faculty of Actuaries in Scotland to the memory of John Napier, the inventor of logarithms.

A cordial vote of thanks was unanimously passed to Mr. Meikle for his gift.

Mr. Randolph Gordon-Smith, F.F.A., was duly elected an Associate.

A paper "On the Requirements of the Life Assurance Companies Act, 1870, in regard to Valuation Returns, with some Notes on the Classification and Valuation of Special Policies", was read by the author, Mr. Ralph Todhunter, M.A.

The following gentlemen took part in the discussion:—Messrs. Ralph P. Hardy, G. J. Lidstone, T. G. Ackland, H. Archer Thomson, E. A. Rusher, George King, and the President.

*The Fifty-second Annual General Meeting, 7 June 1899.*

The President (Mr. H. W. MANLY) in the Chair.

The proceedings at the Annual General Meeting will be found on page 78.

REPORT, 1898-99.

The Council have pleasure to report to the members upon the progress of the Institute during the session of 1898-99, the fifty-first year that it has been in existence.

There has been a *decrease* of 26 in the number of members, as compared with the previous year. This decrease is more apparent than real, and is due to the operation of the new rules as to admission to the Institute (*see* p. 76). Under these rules, 35 candidates have been admitted as Probationers, and 49 as Students, conditionally on their passing Part I of the Examination. A fair proportion of these gentlemen will, no doubt, have qualified themselves for members by passing the requisite Examination in April. At the end of the year in which the Institute was incorporated by the Royal Charter the number of members was 434, while five years



later, at 31 March 1890, it was 601. Since that time it has grown as follows:

At 31 March 1891	to 620,
„ 1892	„ 645,
„ 1893	„ 674,
„ 1894	„ 734,
„ 1895	„ 775,
„ 1896	„ 788,
„ 1897	„ 826,
„ 1898	„ 860.
„ 1899	„ 834.

The following schedule shows the additions, changes, and losses in the membership, which have occurred during the year ending 31 March last.

*Schedule of Membership, 31 March 1899.*

	Honorary Members	Fellows	Associates	Students	Corres- ponding Members	Total
i. Number of Members in each class on 31 March 1898 .	1	189	242	416	12	860
ii. Withdrawals by						
(1) Death . . .	...	2	1	...	...	58
(2) Resignation . .	...	1	4	33	...	
(3) Default in pay- ment of Sub- scriptions . .	...	1	1	15	...	
iii. Additionsto Membership	1	185	236	368	12	802
(1) By Election . . .	...	1	1	...	5	32
(2) By Order of Council	...	...	...	23	...	
(3) By Re-instatement	...	...	...	2	...	
iv. Transfers	1	186	237	393	17	834
(1) By Examination:						
from Associates	...	...	9	...	...	...
to Fellows . .	...	9	...	...	...	...
(2) By Examination:	1	195	228	393	17	834
from Students	...	...	...	...	...	...
to Fellows . .	...	...	...	...	...	...
(3) By Examination:	1	195	228	393	17	834
from Students	...	...	...	20	...	...
to Associates . .	...	...	20	...	...	...
v. Number of Members in each class on 31 March 1899 .	1	195	248	373	17	834

The Council have, with great regret, to report the loss by death of two Fellows, namely, Mr. William Sutton, M.A., and Mr. Charles Thomas Weeden; and one Associate, namely, Mr. John Alexander Robertson.

Mr. Sutton graduated at Cambridge in high mathematical honours, being classed 32nd Wrangler in the Tripos of his year; he joined the Institute during the Session 1866-7, and obtained a certificate of competency in 1869. In 1871 he was appointed Tutor to the Students for the Second Year's Examination, and delivered a course of three Lectures, published in the *Journal* (vol. xvi); and contributed papers to the *Journal*. He was the Author of Part I of the *Text-Book*, published by the Institute in 1882. His great work in relation to obtaining the Charter for the Institute, and in subsequently drafting the Bye-Laws, was gratefully acknowledged by his election as President in 1888.

The accounts for the year show that the total funds on 31 March last amounted to £7,612. 12s. 9d., being an increase during the year of £532. 12s. 4d. A considerable portion of this increase is due to a profit realized on the sale of one portion of the investments of the Institute, namely, Consols. The income from the Stock in which the proceeds have been invested will exceed that derived from the Consols by over £20.

The Annual Subscriptions, together with admission and other fees, amounted to £1,756. 2s. 6d., showing a slight increase as compared with those of the previous year. The total Income for the year was £2,607. 9s. 4d., and the total Expenditure £2,074. 17s. The Revenue Account and Balance Sheet are given herewith (p. 77).

The stock in hand of the Institute publications on 31 March was as follows:

No. of Copies	Description of Work
33 . . . .	<i>Text-Book</i> , Part II.
7 . . . .	Mortality Experience Tables.
781 . . . .	Government Joint-Life Annuity Tables.
847 . . . .	Select Life Tables.
789 . . . .	A Short Collection of Actuarial Tables.
296 . . . .	Logarithm Cards.
339 . . . .	Messenger Prize Essay (Friendly Societies).
90 <i>in cloth</i> )	{ Lectures on Finance and Law (Clare and
3,109 <i>in paper</i> )	
510 . . . .	Index to 10 Vols.
30 . . . .	„ to 20 „
1,025 . . . .	„ to Vols. 21 to 30.
9,366 . . . .	Parts of <i>Journal</i> .

The following papers were submitted at the sessional meetings of the Institute, namely:

28 *November* 1898.—An inaugural address by the President, Mr. H. W. Manly.

19 *December* 1898.—“Debentures of Trading Companies as Investments for Life Assurance Funds, considered in their Legal and Financial Aspects”—Mr. A. R. Barrand.

30 *January* 1899.—“Some Considerations in reference to the Fall in the Rate of Interest experienced in the Past, and the Probability of its Continuance”—Mr. J. Burn.

27 *February* 1899.—“Some Notes on Life Assurance in Greater Britain, particularly with reference to the Work and Development of the Native Offices”—Mr. A. W. Tarn.

27 *March* 1899.—“Some Notes on Sinking Fund Assurances”—  
Mr. J. E. Faulks, B.A.

24 *April* 1899.—“On the Requirements of the Life Assurance  
Companies Act, 1870, in regard to Valuation Returns, with  
some Notes on the Classification and Valuation of Special  
Policies”—Mr. Ralph Todhunter, M.A.

For the Examinations held in the United Kingdom on 21, 22, 24,  
and 25 April last, 203 candidates presented themselves, namely:

68	for Part	I.
70	„	„ II.
35	„	„ III, Section A.
30	„	„ III, „ B.

Of these the following numbers were successful:

30	in Part	I.
25	„	„ II.
9	„	„ III, Section A.
11	„	„ III, „ B.

The following are the successful candidates, the names in each class  
being arranged alphabetically.

#### PART I.

*Examiner*—PROF. S. L. LONEY.

*Supervisors*—MESSRS. W. HUGHES and F. E. COLENZO, M.A.

##### *Class I:*

W. P. Buckler.		S. A. Guest.
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##### *Class II:*

Isaac Barnett.		E. E. Minns.
N. J. Carter.		Stanley Moore.
C. J. Hepburn.		A. L. Pring.
A. F. S. Jackaman.		R. A. Skelton.
L. A. Mouat Jones.		C. Weatherill.
G. Marshall.		C. W. Winstanley.

##### *Class III:*

W. G. Barrett.		C. W. Ecroyd.
H. R. Burdett.		H. L. Giles.
Geo. Clinton.		E. Goddard.
C. A. Collier.		E. D. Kissan.
A. G. D. Court.		R. J. Moore.
E. P. Cross.		E. V. Rutter.
F. De Ville.		J. B. Sharp.
J. J. Douglas.		H. E. Stamp.

#### PART II.

*Examiners*—MESSRS. J. E. FAULKES, L. F. HOVIL,  
A. D. BESANT, B.A., and J. D. WATSON.

##### *Class I:*

None.

*Class II:*

F. L. Collins.  
H. W. Curjel.  
S. G. Dunn.  
G. W. Meade.

T. Peele.  
F. H. Sherriff.  
T. Tinner.  
H. Weatherill.

*Class III:*

S. Adlard.  
T. F. Anderson.  
G. F. Ansell.  
H. Brown.  
H. Dougharty.  
J. P. S. R. Gibson.  
E. F. Horn.  
A. J. Hudson.

F. E. Jelly.  
G. H. Lawton.  
S. H. Pipe.  
J. Rae.  
C. H. Salter.  
P. Schouten.  
L. W. Stewart.  
F. P. Symmons.

G. A. Vokins.

## PART III.

*Examiners*—MESSRS. G. H. RYAN, J. CHISHOLM, H. W. ANDRAS,  
L. M. SIMON, W. P. PHELPS, M.A., and E. A. RUSHER.

## SECTION A.

*Class I:*

†A. T. Winter.

*Class II:*

\*H. E. W. Lutt.

\*R. P. Parker.

*Class III:*

V. Marr.  
†H. Moir.  
\*A. H. Raisin.

\*R. A. C. Thomas.  
†H. M. Trouncer.  
C. F. Whigham.

## SECTION B.

*Class I:*

None.

*Class II:*

†S. J. H. W. Allin.  
H. W. Brown.

A. Fraser.  
\*R. A. C. Thomas.

*Class III:*

†E. H. Brown.  
†E. J. Bull.  
†J. Holliday.

\*H. E. W. Lutt.  
S. Macnaghten.  
\*R. P. Parker.

\*A. H. Raisin.

Those marked (\*) passed in both sections, and with those marked (†), have now completed the examination for the Class of Fellow.

In the Colonies the Examination entries numbered 65, as under:

For Part	I,	36.
„	II,	20.
„	III, Section A,	7.
„	III, „ B,	2.

The results of the Colonial Examinations will be duly announced.\*

The Council warmly acknowledge the valuable services of the Honorary Examiners.

For the benefit of persons who desire to qualify for admission to the Institute, the Council have established a Class of Probationers, who, while not being Members of the Institute, are allowed some of the privileges of Members. Applicants are now usually placed in this class, whence they can become Students on passing Part I of the Examination.

Substantial progress has been made during the year in the work of the new Mortality Experience Investigation. As reported last year, the Investigation is being conducted jointly by the Institute of Actuaries and the Faculty of Actuaries; the contributions of Life Assurance Companies towards the cost of this important work will, it is hoped, go far towards covering the necessarily very heavy expenses. It is with great satisfaction that the Council are able to announce the publication of the volume of Unadjusted Annuity Experience. The remaining portions of the Investigation are in different stages of forwardness under the honorary supervision of Mr. T. G. Ackland. The tabulation of the Endowment Assurance Experience (Male Lives) is completed, and the form and arrangement of the tables to be published are being dealt with by the Committee. The tabulation of the Female Life Experience in all classes, as well as that of the very extensive Whole-Life Experience (Male Lives), is in a forward state.

During the session, a series of six lectures on "The Companies Acts" was delivered by Mr. A. C. Clauson, Barrister-at-Law, in Staple Inn Hall, which will be published very shortly. The lectures delivered in previous sessions, by Mr. Clare on "The London Daily Stock and Share List", and by Mr. Wood Hill on "The Law of Real Property in England", have been published during the year.

The foreign papers read at the Second International Congress have all been translated into English, and the volume of Transactions will shortly be ready for publication.

The Third International Congress will be held in Paris next year, from 25 to 30 June, in an annexe of the Great Exhibition. A Committee has been appointed by the French actuaries to make necessary arrangements, and a Committee of the Institute is attending to matters in this country.

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\* These results are given on page 83.



£r.

*Revenue Account for the year ending 31 March 1899.*

£r.

Amount of Funds at the beginning of the year—	£	s.	d.	£	s.	d.
General Fund . . . . .	6,253	4	10			
Messenger Legacy Fund . . . . .	299	8	1			
Brown Prize Fund . . . . .	250	10	9			
Chisholm Prize Fund . . . . .	25	0	0			
Library Fund . . . . .	251	16	9	7,080	0	5
Subscriptions—						
Fellows . . . . .	517	13	0			
Composition of one subscription . . . . .	31	10	0			
Associates . . . . .	549	3	0			
Students . . . . .	452	11	0			
Probationers . . . . .	386	8	0			
	18	7	d	1,400	9	6
Application Fees—						
Fellows . . . . .	5	5	0			
Associates . . . . .	2	2	0			
Students . . . . .	47	5	0			
Probationers . . . . .	18	18	0			
Examination Fees . . . . .				73	10	0
Sales of Publications—				270	3	0
Journal . . . . .	124	10	7			
Text-Book, Part II . . . . .	94	9	7			
Institute Life Tables . . . . .	16	7	0			
Government Annuity Tables . . . . .	5	14	0			
Select Life Tables . . . . .	18	7	9			
Short Collection of Actuarial Tables . . . . .	2	14	0			
Hardy's Friendly Societies . . . . .	1	15	0			
Legal and Financial Lectures . . . . .	23	18	0			
Logarithm Cards . . . . .	1	11	7			
Dividends and Interest (less tax) . . . . .				290	7	6
Profit on sale of consols . . . . .				192	16	9
				368	2	7
				£9,687	9	9

*Balance Sheet, 31 March 1899.*

	£	s.	d.	£	s.	d.
<b>LIABILITIES.</b>						
General Fund . . . . .						
Messenger Legacy Fund (including proportion of profit on sale of Consols) . . . . .	233	9	2			
Accumulated Dividends . . . . .	101	3	5			
Brown Prize Fund . . . . .	300	0	0	334	12	7
Accumulated Dividends . . . . .	58	5	5			
Chisholm Prize Fund . . . . .				258	5	5
Library Fund . . . . .				25	0	0
				223	17	5
				£7,612	12	9
<b>ASSETS.</b>						
Natal 3 per-cent Inscribed Stock (£3,000), cost . . . . .				2,846	6	0
Metropolitan Railway 4 per-cent Debenture Stock (£1,050), cost . . . . .				1,185	11	3
Great Eastern Railway 4 per-cent Debenture Stock (£800), cost . . . . .				1,031	10	3
Great Northern Railway Preferred Ordinary Stock (£600), cost . . . . .				703	11	6
Great Western Railway 4½ per-cent Debenture Stock (£500), cost . . . . .				972	19	9
Outstanding Subscriptions . . . . .				77	14	0
Cash on Deposit Account . . . . .				£500	0	0
Current Account . . . . .				293	0	0
				795	0	0
<i>Examined and found correct, 25 April 1899.</i>						
H. R. HARDING, } <i>Auditors.</i>						
C. H. E. REA, }						
L. K. PAGDEN, }						
				£9,687	9	9

Journal—	£	s.	d.	£	s.	d.
Printing of Nos. 189, 190, 191, and 192 . . . . .				470	17	10
Clerical assistance . . . . .				35	0	0
Library—binding and purchases . . . . .						
Meetings . . . . .						
Examination charges . . . . .						
Actuarial tables . . . . .						
Congress expenses . . . . .						
Lecturers for classes in Parts I and II . . . . .						
Lectures on Finance and Law . . . . .						
Legal charges . . . . .						
Office Expenditure—						
Rent . . . . .				275	0	0
Salaries . . . . .				346	10	4
House expenses . . . . .				52	3	2
Corporation duty . . . . .				7	8	6
Fire Insurance . . . . .				13	8	0
Stationery and Printing . . . . .				155	13	6
Postage and Telegrams . . . . .				36	9	0
Furniture . . . . .				38	10	0
Sundries . . . . .				2	18	6
Amount of Funds at the end of the year, as per Balance Sheet . . . . .				928	1	0
				7,612	12	9

*Examined and found correct, 25 April 1899.*

H. R. HARDING, } *Auditors.*  
 C. H. E. REA, }  
 L. K. PAGDEN, }

[The Institute also possesses certain copyrights and stocks of publications (see p. 73).]

## PROCEEDINGS AT THE ANNUAL GENERAL MEETING.

The Report of the Council (given on p. 71) having been read,

The PRESIDENT said—It is now my pleasant duty to move that the report of the Council be adopted—pleasant, because there can be nothing but congratulation on the progress and success in every department of the work of the Institute, a pleasure which is only marred by the hand of death, which has removed two valued members from our list of Fellows, one in middle life and the other in youthful manhood. Of the loss we have sustained by the death of Mr. Sutton I have already spoken. A man of keen intelligence and strict integrity, who rendered great services to the Institute in many ways, and not the least in the exercise of that indomitable perseverance and stern tenacity of purpose which overcame all opposition to the grant of our Charter—(hear, hear)—a work for which his name will be for ever honourably associated with the Institute. (Applause.) By the death of Mr. Weedon we have lost one of the most promising of our young actuaries. He passed all his examinations with great credit at an early age, and in his answers displayed considerable mathematical ability, a retentive memory, and a thorough knowledge of a wide range of subjects. These qualities brought him under the notice of his seniors, and he was engaged by them to assist in many intricate investigations; a man of gentle manners, yet one who inspired confidence and respect. Just before his death he received an appointment which would have been the stepping-stone to the high position which he seemed destined to fulfil, but so suddenly was he called from us that he never entered upon his new duties. Well might it be said of him, “Whom the gods love die young.” (Hear, hear.) I cannot disguise my great pleasure at the very hearty and generous response which the younger members have given to my invitation. The past session was essentially a junior members’ session. The papers were written by our junior actuaries, and a larger number than usual of the junior members took part in the discussions. The innovation which I ventured to make of inviting junior members to act as referees has proved a great success. It has forced them to display those latent talents which had so long been lying dormant, and inspired others to emulate them. I look forward with great expectations to a further development of these talents on future occasions. Of the papers I need not speak in detail. They cover a wide field of enquiry and research, and the authors have displayed an intelligent grasp of their respective subjects, and a faculty for exhaustive enquiry. Their example will, I trust, stimulate others to come forward and reveal that latent ability which exists in such great abundance. The new regulations with regard to admission to the class of student have had the effect of retarding for a time the increase in our numbers. As stated in the report, the decrease was more apparent than real, for by the old system we should have admitted as students the 35 probationers, and the 49 applicants approved, subject to their passing Part I of the examinations—that is, together, 84—and deducting the decrease in the numbers, would show upon the old system an increase of 58, the largest increase in any one year except 1893-94, when the increase was 60. The new regulation has worked admirably. Instead of the number of applicants decreasing they have actually increased, and although some of them may have been disappointed that they could not become members without passing the first examination in the syllabus of examinations, it has greatly relieved the anxiety of the Council as to the probable ulterior objects which some of the candidates might have had in applying to be admitted as members. Searching through the early volumes of the *Journal* recently, I discovered that in enforcing this new regulation we were only reverting to the early practice of the

Institute, for I found that I passed my first examination in December 1860—at the same time as Mr. Ralph Hardy and Mr. Strachan—and that I and three others who passed at the same time were elected Associates at the following meeting, the Council at the time having been satisfied that we were then worthy to become members. Of the 35 probationers 9 have succeeded in passing the examination, and of the 49 applicants, who were elected subject to their passing Part I, 8 have succeeded in passing; so that 17 out of the 58 will now become members of the Institute. There are still, of course, the returns from the Colonies to come in; these may increase the numbers who have passed from the probationary class into the class of members. Turning now to the accounts, it will be seen that we continue to be in a prosperous condition. The annual income has increased, and although the expenditure includes two special items of £85 for Congress expenses and £215 for lectures on law and finance, the funds have increased by £532; but this includes a profit of £368, which was realised on the sale of Consols. Omitting that item, the income has exceeded the expenditure by £164. I feel it to be a source of satisfaction that we have been able to employ our income for the benefit of the members and for the advancement of the objects of the Institute, for it is no part of the function of a society like ours to accumulate wealth. Torpor always seems to steal over the activity and usefulness of the rich, and the greatest vitality and energy are always found in those institutions which are not troubled with the difficulties of investments. (Laughter.) At the same time I cannot help remarking on our success as traders and financiers in a small way. The outlay upon our publications, which are very expensive to produce, nearly all comes back to us from sales, although we fix the price so low for members that we never anticipate making a profit. Probably, however, that is the reason why we do make a profit. The mention of publications reminds me that we have only 33 copies of the *Text-Book*, Part II, left for sale, and none of Part I. You will be pleased to hear that we shall shortly be publishing a second edition of Part II, revised by the author, Mr. George King—(applause)—and that Mr. Todhunter has undertaken, at the invitation of the Council, to rewrite Part I. (Applause.) Passing to the examinations, I believe I am correct in saying that a larger number of candidates presented themselves in April last than in any previous year, there being 203 in the United Kingdom and 68 in the Colonies. While heartily congratulating those who have passed, I desire to extend a word of sympathy and encouragement to those who have failed. I notice that the proportion of those who have passed is similar to that on previous occasions, and while many who failed showed a large amount of knowledge and earnest study, although they did not come up to the standard, and who, therefore, may hope with another year's instruction to be successful on the next occasion, yet there were some, and a not inconsiderable number, who presented themselves in a totally unprepared state, probably on the off-chance of scoring a pass. (Laughter.) Now, I would remind the latter class that the Examiners, with the exception of the paid Examiner for Part I, give their services free to the Institute, that they are all busy men, and that the work of setting the papers and examining the answers is an extremely onerous one, and it is not fair to them that men should present themselves when they know that they have not the ghost of a chance of passing. I am sure it is not a good thing for the men themselves. It begets a careless habit, and shows a want of common intelligence. To the Examiners our heartfelt thanks are due for those services so freely given, their reward being the consciousness that they are helping forward the Institute which has in past times helped them. In pursuance of the educational system, which was inaugurated by a series of lectures on the "Law of Real Property", by Mr. Wood Hill, followed by the lectures on the "London Daily Stock and Share List", by Mr. Clare, the committee invited Mr. A. C. Clauson to deliver last session a series of



lectures on "The Companies Acts", a subject of very great importance, but presenting a very formidable appearance to the student. I am, I believe, expressing the opinion of all attending those lectures—and they were very largely attended—that they were a great success. (Applause.) Mr. Clauson, who is a perfect master of company law, has a very happy style of explaining in simple language, and without technicalities, the most difficult points of law, and succeeded in making a dry subject most interesting. These lectures are now in type, and will shortly be published, and the students will thus have another useful hand-book to their studies. (Hear, hear.) I have now to make the announcement, which I am sure will be received with the greatest satisfaction, that the great enterprise in which the Institute of Actuaries and the Faculty of Actuaries in Scotland have jointly been engaged, namely, the new mortality investigation, is fast approaching its close, so far as the production of the unadjusted data is concerned. I hold in my hand the bound volume of the unadjusted annuity data, and copies of it will be in the hands of subscribers in a few days. (Applause.) The tabulation of the endowment assurance mortality experience (which represents the experience of 140,000 policies and 940,000 years of life, and 6,000 deaths) has been completed, and it will not be long before it is issued. We confidently believe that the whole of the operations through which the one million of whole-life assurance cards have to pass prior to tabulation will be completed before the end of the year. I have here the statistics of the ordinary life policies—that is to say, where the premiums are payable during the whole of life, comprising 734,000 lives and 196,000 deaths. That should certainly give us a most complete experience of this class of policy. I have every hope of being able to announce at the annual meeting next year, not only that the whole of the unadjusted tables have been published, but that the graduation has been successfully accomplished, and rapid progress made with the computation of the monetary tables. The time employed may have seemed long, but it has not been wasted. The large staff, under the able direction of Mr. Ackland, has been working for three years at full pressure, and when earnest consideration was being given by the committee to the second and subsequent stages of the early sections of the work, the other sections were being put through the first stages; and thus it happens that the later sections put in hand have nearly caught up to the first part. It is no exaggeration to say that this monumental work will prove to be the most valuable experience ever collected and tabulated on sound scientific principles, and that in its conception, execution, and accomplishment the Institute and Faculty have performed a great public service. There is another important and interesting announcement I have to make. The proceedings of last year's International Congress, which will form a volume of about one thousand closely printed pages, are in type, and will shortly be in the hands of the members. It will contain the most complete record of the history and development, up to the present time, of many of the great social problems involving the application of actuarial science for their solution throughout the world; and I say it without fear of contradiction, that the libraries of statesmen, social reformers, and actuaries will not be complete without a copy of it. The burden of editing the work has fallen upon Mr. George King, and when I tell you that all the foreign papers have been translated into English, and the originals and translations revised by the authors, you can understand what a heavy task it has been, and the endless toil and unwearying energy Mr. King must have exercised in producing this work, and Mr. King I am sure deserves, and will receive, an international vote of thanks for his labours. (Hear, hear, and applause.) There is only one more announcement I have to make before I close. The latent ability which I have mentioned as existing in such abundance amongst young members is a plant that sometimes requires stimulating and directing in order to make

it blossom and bear fruit, and as a stimulus the Council have under consideration the offering of prizes out of the Brown Fund or the Messenger Fund, or both of them—probably both of them—on subjects of great importance. Mr. Chisholm very kindly in 1896 offered two prizes of the value of £50 and £25, but the adjudicators only awarded one prize. Mr. Chisholm generously left the £25 in the hands of the Council for disposal, and the Council have decided to offer two prizes of £15 and £10 respectively for the two best essays on “The Rationale of the Bonus-discounted Premium”, to be competed for by those who have qualified for the Fellowship during the last three years. This is a new departure, limiting the competition to the younger members of the Institute, but it accords with Mr. Chisholm’s wishes that the young members should be invited to write essays on practical subjects, and here I hope that we shall have a great display of talent and a good competition, and that we shall not be disappointed. The syllabus will be issued shortly. In speaking of these prizes, I should like to say that it is not the money value which is of so much importance as the reputation for original thought and clear demonstration that naturally follows. I, of course you know, speak from experience—(hear, hear)—and I am sure all the other prize essayists will agree with me when I say that it was the prize essay which raised us above the common level, and helped us more than anything else to those positions which we hold. I may say that the most valued of my possessions is the £10 worth of books which was the prize awarded to me on the 1st January 1868. (Loud applause.) I now move “That the report of the Council and statement of accounts be received and adopted.” (Applause.)

Mr. WM. HUGHES, in seconding the motion, said there remained very little to add to the President’s address. He would say a word, however, with regard to the competition which had been announced for the balance of the fund so generously offered by Mr. Chisholm. As stated by the President, the last session was a junior members’ session, there having been a growing wish on the part of the Council to encourage in every way the talent amongst the younger men. When the matter came up for discussion it was felt that as there might be some talented but timid juniors who would never go in for a prize (although perfectly competent to do so) if they were placed in competition with men much their seniors, whom they might suppose were their superiors in ability, the decision arrived at was that the field should be restricted. It was, therefore, hoped that there would now be a large entry in the instance referred to, and especially as this was, he thought, the first occasion on which three prizes were offered at one time. (Applause.)

The motion was then put and carried with acclamation.

Messrs. Colquhoun and Rea were appointed scrutineers of the ballot for the election of the President and the other officials.

The PRESIDENT announced, as the result of the balloting, that the following had been unanimously elected:—

#### *President.*

HENRY WILLIAM MANLY.

#### *Vice-Presidents.*

WILLIAM HUGHES.  
GERALD HEMMINGTON RYAN.

FRANK BERTRAND WYATT.  
JAMES CHISHOLM.



*Council.*

THOMAS G. C. BROWNE.	CHARLES DANIEL HIGHAM.
*DAVID ALEXANDER BUMSTED.	WILLIAM HUGHES.
ARTHUR FRANCIS BURRIDGE.	GEORGE KING.
*JAMES CHATHAM.	HENRY WILLIAM MANLY.
JAMES CHISHOLM.	GEOFFREY MARKS.
*FRANCIS ERNEST COLENZO, M.A.	WILLIE OSCAR NASH.
ERNEST COLQUHOUN.	PHILIP LEWIN NEWMAN.
GEORGE STEPHEN CRISFORD.	*HARRY ETHELSTAN NIGHTINGALE.
ROBERT CROSS.	GERALD HEMMINGTON RYAN.
*STANLEY DAY.	JAMES SORLEY.
JOSEPH ERNEST FAULKS, B.A.	THOS. BOND SPRAGUE, M.A., LL.D.
ALEX. JOHN FINLAISON, C.B.	GEORGE TODD, M.A.
GEORGE FRANCIS HARDY.	ERNEST WOODS.
RALPH PRICE HARDY.	FRANK BERTRAND WYATT.
AUGUSTUS HENDRIKS.	THOMAS EMLEY YOUNG, B.A.

\* New Members of the Council.

*Treasurer.*

CHARLES DANIEL HIGHAM.

*Honorary Secretaries.*

ARTHUR FRANCIS BURRIDGE.		ERNEST WOODS.
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Mr. BARTON had great pleasure in proposing the election of Messrs. Rea, Pagden, and Mackay as auditors for the ensuing year.

Mr. SEARLE seconded, and the motion was carried.

Mr. S. G. WARNER, in proposing a hearty vote of thanks to the President, Members of the Council, Officers of the Institute, and the Examiners, for their services during the past year, said he was sure all would cordially agree that they deserved it. The President had the interests of the Institute at heart, and as they saw it grow in magnitude and importance, as did also kindred societies, it became all the more important that they should have at their head a true representative man. In a science like theirs, which combined theory and practice, it was more especially important that the President should be an actuary of proved experience, judgment, and ability. The Institute had been singularly fortunate in their list of Presidents, and all would agree that the illustrious succession had been maintained by the present holder of the office. (Loud applause.) As to the Council and Officers, it was well known that in the work of an institution of this kind much depended upon detail which was often wearisome, and involved a great deal of voluntary devotion of time, which never came out before the members, but upon which the smooth working and much of the success depended. The officers had done their duties during the past year with a great sacrifice of leisure, and the least that could be done was to cordially thank them. (Hear, hear.) As to the Examiners, they were a most deserving race of men. (Applause.) Their work, as the meeting had been informed, increased with a rapidity which in some sense was gratifying, but which, in the view of those who undertook the work, was little short of appalling. It might certainly be said, as was said of one of the Elizabethan heroes, Sir Walter Raleigh, they "toil terribly", and they deserved the warm thanks of all the examinees, especially the unsuccessful ones. Whether they got it or not he could not

say, but at all events they would receive the thanks of the meeting. There was a precedent set which he would follow, namely, including the name of Mr. Ackland in the vote. Mr. Ackland acted as supervisor of the laborious mortality investigation of which they had heard, which was making such headway, and which, when finished, would undoubtedly be a landmark in the history of the Institute and all actuarial science.

Mr. D. A. BUMSTED said he had much pleasure in seconding the proposition. Everyone who had studied the report must be satisfied that the President and Council had gone through a large amount of work, and it was gratifying to find that everything was so calm, and working so smoothly.

The motion was put, and carried amid applause.

The PRESIDENT—On behalf of myself and my colleagues, the Council, the Officers, and Examiners, and Mr. Ackland, I beg to thank you most cordially for the way in which this vote has been proposed, and for the manner in which you have received it. I can assure you that to us the labours which Mr. Warner was good enough to refer to, although great, have been a great pleasure. We do not require the stimulus of a vote to keep us to those labours, but it is very pleasing indeed to receive such a compliment as is conferred by this vote. (Applause.)

Mr. COCKBURN proposed a vote of thanks to the auditors for their services during the past 12 months. Their work had not tended to diminish, and the members owed to them their best thanks for all they had undertaken and performed.

Mr. A. G. HEMMING seconded the proposition, which was carried.

Mr. C. H. REA, in responding, said that Mr. Harding had quite recently renounced the actuarial profession, and had gone into partnership in an important commercial corporation in Glasgow. They regretted his loss exceedingly, and all would, no doubt, be unanimous in trusting he would be successful in his new sphere of life. The books were always kept in an excellent manner. Mr. Wiggins had been most courteous, and everything had been placed in the hands of the auditors in an eminently satisfactory way.

The proceedings then terminated.

## COLONIAL EXAMINATIONS.

1899.

Examinations were held on 21, 22, 24, and 25 April, at Sydney, Melbourne, Adelaide, Wellington, Montreal, and Toronto, with the following results:

### PART I.

Thirty-six Candidates sent in their names, of whom thirty-two presented themselves, and nineteen passed as follows:

#### *Class I:*

De Lury, G. (Toronto).  
Fitzgerald, W. G. (Montreal).  
Gray, R. A. (Toronto).

#### *Class II:*

Collins P. A. (Sydney).  
Earle, A. P. (Toronto).  
Stuckey, R. R. (Adelaide).  
Williams, W. (Sydney).

*Class III:*

Baber, W. C. (Montreal).  
 Brady, J. F. (Sydney).  
 Burnley, Isaac (Wellington).  
 Cherry, C. F. (Sydney).  
 Cotterill, W. E. (Sydney).  
 Davison, H. W. (Toronto).

Dorrian, J. C. (Sydney).  
 Gordon, H. D. L. (Toronto).  
 Grigg, B. (Montreal).  
 Halloran, G. H. (Sydney).  
 Hunter, R. G. (Toronto).  
 Scott, A. L. (Melbourne).

## PART II.

Twenty Candidates sent in their names, of whom ten presented themselves, and two passed as follows:

*Class II:*

Kelly, J. J. (Sydney).

*Class III:*

Catchlove, C. H. L. (Adelaide).

## PART III (SECTION A).

Seven Candidates sent in their names, of whom four presented themselves, and two passed as follows:

*Class III:*

Harris, F. J. (Sydney).  
 Little, J. F. (Sydney).

## PART III (SECTION B).

Two Candidates sent in their names and presented themselves, but neither succeeded in passing.

## INTERNATIONAL CONGRESS OF ACTUARIES, 1900.

THE Programme and Regulations of the Third International Congress of Actuaries, to be held in Paris, on 25-30 June 1900, have been settled, after consultation with the Permanent Committee, by the Organizing Committee (appointed by the Institute, of French Actuaries), of which M. Paul Guieyette is President and M. Léon Marie, Secretary. For the purpose of making the necessary arrangements in England, the Council of the Institute of Actuaries have appointed a Committee, consisting of the President, the Vice-Presidents, the Honorary Secretaries, and Messrs. Cockburn and King. All communications should be addressed to the Secretary of the Congress for

England, Mr. Ernest Woods, 28 King Street, Covent Garden, London, W.C., who will receive subscriptions and answer enquiries.

In order to facilitate the printing and translation into French, it is hoped that contributors will send in their papers as soon as possible, not waiting for the date mentioned in the Regulations.

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PROGRAMME OF THE THIRD INTERNATIONAL CONGRESS  
OF ACTUARIES (PARIS, 1900).

*Subjects for Discussion.*

1. Insurance against invalidity, whether arising from sickness, old age, or accident—Definition of the risk—Investigation and estimation of claims—Form of the indemnity—Statistics and necessary tables—Calculation of premiums—&c.
  2. Methods of valuation and distribution of surplus of life offices—The results obtained by different methods.
  3. Comparison of the rates of mortality in various countries—Extra premiums for travel and residence in countries where the rate of mortality is abnormal, more especially in the Tropics.
  4. Comparison of the rates of mortality in various occupations—Extra premiums for the more dangerous occupations.
  5. Methods employed for the valuation of the negotiable securities included in the assets of a company—Estimated values based on the purchase price—Estimated values based on market values—Mixed systems—&c.
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REGULATIONS OF THE THIRD INTERNATIONAL CONGRESS  
OF ACTUARIES (PARIS, 1900).

ART. 1.

The Congress shall confine itself to the consideration of questions relating to Actuarial Science.

ART. 2.

The following persons shall alone be qualified to become members of the Congress:

1. Delegates nominated by their respective Governments to act as their official representatives at the Congress.
2. Members of established Actuarial Societies.
3. Members of the Permanent Committee of Actuarial Congresses.

4. Members of the Congresses held in Brussels in 1895, and in London in 1898.

5. Actuaries in active practice in public or private institutions known to the Organizing Committee.

6. Persons exceptionally admitted by the Organizing Committee on the nomination of a member of the Congress previously inscribed on the list of members and belonging to one of the five foregoing classes.

#### ART. 3.

In order to become a member of the Congress, any person belonging to one of the classes set out in Article 2 must forward before 1 June 1900, to the Secretary of the Organizing Committee, a written intimation that he desires to become a member, together with a minimum subscription of 20 francs.\*

Correspondents have been appointed in various countries to receive and forward applications and subscriptions.

#### ART. 4.

The Organizing Committee may appoint Presidents, Vice-Presidents, and honorary members of the Congress.

#### ART. 5.

Every member of the Congress (as defined in Art. 3) shall receive a card entitling him to take part in the meetings and to receive free of charge the volume of the proceedings which will be published under the authority of the Organizing Committee. Any surplus copies of the volume will be sold at a minimum price of 20 francs each.

#### ART. 6.

The programme of the business of the Congress shall be drawn up by the Organizing Committee in concert with the Executive Council of the Permanent Committee (regulations of Permanent Committee, Art. 2), and will be forwarded to all members in good time before the Congress.

#### ART. 7.

The Organizing Committee, in concert with the Executive Council of the Permanent Committee will nominate a list of Referees for any questions appearing in the programme. Such Referees will represent as far as possible the various countries which take part in the Congress.

The Organizing Committee may accept for discussion by the Congress papers on subjects having relation to Actuarial Science although not mentioned in the programme.

All papers and reports should be sent to the Secretary of the Organizing Committee not later than 1 April 1900, *at the very latest*, so that they may be translated and printed before the opening of the Congress.

#### ART. 8.

The official language of the Congress shall be French, but papers and speeches may be in English or German. The Organizing Committee will endeavour to have as many as possible of the papers and reports translated.

\* Equivalent to 16 shillings, 16 marks, 4 dollars, 19 crowns,  $7\frac{1}{2}$  roubles  $9\frac{1}{2}$  florins, &c.



## ART. 9.

The meetings will be held in the "Palais des Congres" of the Exhibition \* on the days and at the times undermentioned:

1. Monday,	25	June 1900	at 2 p.m.
2. Tuesday,	26	"	9.30 a.m.
3. Wednesday,	27	"	9.30 a.m.
4. "	27	"	2.30 p.m.
5. Thursday,	28	"	9.30 a.m.
6. Friday,	29	"	9.30 a.m.
7. "	29	"	2.30 p.m.
8. Saturday,	30	"	9.30 a.m.

## ART. 10.

The Bureau of the Permanent Committee provisionally installed in Office by the Organizing Committee will declare the Congress open and proceed to the election of officers of the Congress as follows:

1. All the members present will elect a President and a General Secretary, an absolute majority of those present being required. If there be no such absolute majority, then a ballot shall be taken and the election shall be determined by a bare majority of votes.

2. Each group of members of the same nationality shall elect out of their own number a Vice-President and a Secretary, provided that there be 15 such persons of the same nationality members of the Congress and five present at the time of voting.

The members of other nationalities shall form another group and shall also elect a Vice-President and a Secretary in the same manner.

## ART. 11.

It shall be the duty of the President to direct the work of the Congress and to act as chairman at its meetings. He may be replaced by one of the Vice-Presidents to be nominated by him, or failing such nomination, by the Bureau.

## ART. 12.

The Congress shall have full power to decide any point which is not provided for by the Regulations of the Permanent Committee or by the present Regulations.

## ART. 13.

The Accounts shall be kept in the name of the Organizing Committee, which alone shall have full power to regulate the receipts and expenses and to dispose of any surplus (Rules of the Permanent Committee, Art. 7).

No member of the Congress shall be liable for any claim or demand beyond the subscription fixed by Art. 3.

## ART. 14.

Membership of the Congress is subject to the present Regulations and to those of the Permanent Committee.

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\* Near the "Place de l'Alma."

REGULATIONS OF THE PERMANENT COMMITTEE OF  
INTERNATIONAL ACTUARIAL CONGRESSES.

## ART. 1.

The Permanent Committee of International Actuarial Congresses is established to be a bond between the Actuaries and also the Associations of Actuaries of various countries. Its head-quarters are at Brussels.

## ART. 2.

It has for objects:

1. To originate and to follow out all works or researches interesting in the science or in the practice of the Actuary.

2. To publish periodically a Journal; *a.* bringing together all information, technical, legislative, statistical, or juridical, bearing upon Actuarial Science; *b.* summarizing the publications and the works, which appear in the different countries, bearing upon Actuarial matters; *c.* giving space, moreover, to original contributions of general interest to Actuaries.

3. To co-operate with the *Organizing Committees* in the preparation of the work of International Congresses, and in the publication of their proceedings.

## ART. 3.

The *Associate* members of the Permanent Committee shall be all those who are admitted by the *Executive Council*, hereinafter defined, and who undertake to pay an annual minimum contribution of 10 fres.

The *Donation* members shall be those Associate members who undertake to pay a minimum annual contribution of 50 fres. Their names shall be published each year in the Journal, with a memorandum of the sums paid by them.

*Associate Life* members shall be those of the Associate members who have compounded for their annual subscriptions by a minimum payment of 200 fres., made in instalments during one or two years at the most.

*Donation Life* members shall be those Donation members who have compounded for their annual subscriptions by a minimum payment of 1,000 fres., made in instalments during one or two years at the most.

Public (Governmental) Departments of the different countries, Assurance Companies, and generally all Institutions, Societies, or Associations, having for their object the study, or the practical application of, thrift and Social Economy, may become Associate members, or Donation members, of the Permanent Committee.

The Associate members and the Donation members shall receive free the Journal of the Permanent Committee.

## ART. 4.

The Permanent Committee shall be governed by an International *Executive Council* consisting of 40 members, and including the 33 members who were appointed by the first International Congress of Actuaries at its meeting of 6 September 1895, and such members as shall be in future elected by the Executive Council itself, proceeding by co-option.

Each country possessing Actuaries shall be, as far as possible, represented on the Executive Council by one or several members.

The members of the Executive Council shall be elected for four years and shall be eligible for re-election.

The re-election shall take place each year and by one-fourth of the members of the Council. During the transitional state the members to retire 1897, 1898 and 1899 shall be decided by lot.

The election shall be made by those members not retiring, and it can take place by correspondence.

ART. 5.

Each year the Executive Council shall choose from among its own members a *Bureau* consisting of a President, seven Vice-Presidents, a General Secretary, a Treasurer, and seven Secretaries, distributed, as far as possible, among the members representing the different countries.

The Executive Council may moreover nominate correspondents, whose duty it shall be to represent it in those countries where it is not represented by any member of the Bureau. It may also co-opt, as temporary consultative members, members of the Permanent Committee not already on the Executive Council, to carry through matters remitted to it by International Congresses.

The election of the Bureau may take place by correspondence.

ART. 6.

The Executive Council shall meet, as a rule, at the head-quarters of the Permanent Committee, and shall be convened by the President, or, failing him, by the General Secretary. The Bureau may, nevertheless, convene a meeting of the Council in any other town, when special circumstances seem to justify such an exceptional course.

Notice of meeting, accompanied by a detailed agenda, shall be sent to each member of the Executive Council at least one month before the date fixed for the meeting. Those members who find themselves unable to attend at a meeting may send to the President their views on the questions on the agenda.

In case of urgency, the President and the General Secretary may take such steps as may be found necessary, provided always that they submit them at the earliest possible moment for ratification by the Executive Council.

Decisions of secondary importance may be taken without convening a meeting of the Council, on the vote of an absolute majority of the members of the Executive Council, given by correspondence on the invitation of the President.

Ten members of the Executive Council shall form a quorum. If this number be not present at a meeting, the President may take a vote by correspondence as explained in the last preceding paragraph.

The Executive Council may authorize those members, who, on account of the distance of their residence, are unable to send in their views by correspondence within one month, to be represented, for the purpose of voting, by European members of the Council.

In case of equality of votes, the President shall have a casting vote.

ART. 7.

The place and date of each International Congress shall be fixed either by the last preceding Congress, or, failing that, by the Executive Council, which in such case shall be guided by the convenience of the Actuaries of the different countries interested, and by the advice of the Societies of Actuaries established in those countries.

The Executive Council shall establish in the country designated, an *Organizing Committee*.

The Organizing Committee shall prepare a programme of the business in concert with the Executive Council. It shall defray all expenses of the Congress, and of publishing its proceedings.

During the period in which the International Congress is being organized, two members of the Organizing Committee of such Congress shall be temporarily added to the Executive Council, and shall have the same powers as the ordinary members.

## ART. 8.

The income of the Permanent Committee shall consist :

1. Of the contributions of its members ;
2. Of the subsidies that may be granted to it by public (Governmental) departments of the different countries ;
3. Of the subsidies which may be granted to it by the different Institutions, Societies or Associations ;
4. Of the interest on its invested funds, and of sundry receipts.

## ART. 9.

There shall be formed a Reserve Fund, into which shall be paid :

1. The sums received in commutation of subscriptions ;
2. The contributions and subsidies made on the condition that they shall be placed to the Reserve Fund ; and
3. Such sums as the Executive Council shall think wise to carry to the Reserve Fund.

The Reserve Fund shall be invested in the public debt of Belgium. It cannot be trencched upon except by a formal decision of an International Congress taken on the motion of the Executive Council. The income derived therefrom may be applied to defray the ordinary expenses.

## ART. 10.

The present regulations cannot be altered except by a future International Congress on the motion of the Executive Council or at the request of 25 members of the Congress. In this latter case the proposal must be communicated to the Executive Council at least one month before the date fixed for the opening of the Congress.

## ART. 11.

With the formalities prescribed in the last preceding article, any future International Congress may, by a majority of two-thirds at least of the members present, dissolve the Permanent Committee, and dispose of the available capital, as also of all documents, works, and sundry archives, belonging to the Committee.

### *Additions to the Library.*

The following works have been added to the Library since the publication of the *Journal* for October 1898:

	<i>By whom presented (when not purchased).</i>
Actuarial Society of America.	
Proceedings of the	} <i>The Society.</i>
Secretary's Report for the Ten Years beginning	
25 April 1889.	
Actuarial Society of Edinburgh.	
Proceedings of the	<i>The Society.</i>
American Statistical Association.	
Quarterly Publications of the	<i>The Association.</i>

- By whom presented  
(when not purchased)*
- Australasian Insurance and Banking Record for December, 1898. *W. R. Day.*
- Australian Mutual Provident Society.  
Jubilee Report, 1849-1899. *A. M. P. Society.*
- Austria.  
Mittheilungen des Verbandes der oesterr. und ungar.  
Versicherungs Techniker. *Anonymous.*  
Zpráva úrazové pojistovny delnické pro Kralovstvi ceske  
v praze o einnosti v dobe od 1. Dedna do 31.  
Prosinee. 1897. *Anonymous.*  
Another copy in German.
- Beevor (Sir Hugh), Bart., M.D., F.R.C.P. Lond.  
The Declension of Phthisis. *The Author.*
- Belgium.  
Bulletin de l'Association des Actuaires Belges. *L' Association.*  
Comité Permanent des Congrès internationaux  
d'Actuaires. Bulletins 1, 2, and 3. 2nd Edition. *Le Comité.*  
Compte Rendu des Operations et de la Situation de la  
Caisse Générale d'Epargne et de Retraite. 1898. *The Belgian Govt.*
- Bentham (Jeremy).  
Defence of Usury. 1898. *Purchased.*
- Birmingham, Insurance Institute of.  
Transactions, 1897-1898. *Insurance Institute.*
- Bourne (Arthur).  
Tables of Reciprocals. *The Author.*
- Bourne's Insurance Directory for 1899. }
- Bourne's Assurance Guide. } *Wm. Schooling.*
- Bourne's Handy Assurance Manual, 1899.
- Brabrook (E. W.), C.B.  
Provident Societies and Industrial Welfare. 1898. *Purchased.*
- British Columbia.  
Year Book, 1897. *The Govt. of B.C.*
- Canada.  
Report of the Superintendent of Insurance for the  
Dominion of, 1896 and 1897. *T. B. Macaulay.*
- Coglan (T. A.).  
The Seven Colonies of Australasia, 1897-8. }
- The Wealth and Progress of New South Wales, 1897-8. } *The Author.*
- Dawson (Miles M.).  
Practical Lessons in Actuarial Science. } *The Spectator Co.  
of New York.*



*By whom presented  
(when not purchased).*

**Eldridge (George Dyre).**

- |   |   |                    |
|---|---|--------------------|
| Assessment System of Life Insurance.          | } | <i>The Author.</i> |
| The Principles of Reservation.                |   |                    |
| What shall be done with Assessment Insurance? |   |                    |

**France.**

- |  |   |                    |
|--|---|--------------------|
| Bulletin de l'Institut des Actuaire Français.  | } | <i>L'Institut.</i> |
| Rapport par la Commission de Surveillance de la Caisse d'Amortissement et de la Caisse des Dépôts et Consignations sur les opérations de l'année 1897. |   |                    |
| Rapport de la Commission Supérieure des Caisses d'Assurances en cas de Décès et en cas d'Accidents. 1897.  |   |                    |
| Rapport de la Commission Supérieure de la Caisse Nationale des Retraites pour la Vieillesse. 1897.   |   |                    |

**Fouse (L. G.).**

- |  |                    |
|--|--------------------|
| Legislative, Actuarial, and Official Treatment of the Assessment System of Life Insurance. | <i>The Author.</i> |
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**Germany.**

- |  |  |
|--|--|
| Assecuranz-Almanach, 1899. By Dr. A. F. Elsner.  | <i>The Author.</i>                     |
| Die Deutschen Lebens-und Unfall-Versicherungs-Gesellschaften.  | <i>Anonymous.</i>                      |
| Die Reform Beamten-Pensions-Institutes der Mitglieder des Assekuranzvereins von Zuckerfabriken in der Österreichisch-Ungarischen Monarchie zu Prag. By Prof. Dr. Joh. Karup. | <i>The Author.</i>                     |
| Zeitschrift des Königlich Preussischen Statistischen Bureau. 1899.   | <i>The German Government.</i>          |
| Zustand und Fortschritte der deutschen Lebensversicherungs-Anstalten im Jahre 1898.  | <i>Lebensversicherungsbank, Gotha.</i> |

**Hellyer (Arthur Lee), A.C.A.**

- |   |                    |
|---|--------------------|
| Depreciating Assets, Sinking Funds, and Kindred Subjects. | <i>The Author.</i> |
|---|--------------------|

**Hill (G. Wood), Barrister-at-Law.**

- |  |   |                      |
|--|---|----------------------|
| The Law of Real Property in England. Being a course of Lectures delivered at the Institute during the Session 1896-97. | } | In<br>One<br>Volume. |
|  |   |                      |

**Clare (George).**

- |  |  |
|--|--|
| The London Daily Stock and Share List. Being a course of Lectures delivered at the Institute during the Session 1897-98. |  |
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**Holland.**

- |   |   |                                    |
|---|---|------------------------------------|
| Jaarboekje van de Vereeniging voor Levensverzekering, 1899.   | } | <i>The Algemeene Maatschappij.</i> |
| Nationale Levensverzekering-Bank. Verslag over het jaar 1898. |   |                                    |

*The Directors.*

- By whom presented  
(when not purchased).*
- Institute of Chartered Accountants.**  
List of Members, 1899. *The Institute.*
- Institution of Civil Engineers.**  
List of Members, 1899. *The Institution.*
- Insurance Blue Book for the years 1890-91, 1891-92,  
1892-93, 1893-94, 1896-97, 1897-98, and 1899-1900.** *Champaness & Co.*
- Inwood's Tables for the Purchasing of Estates, etc.**  
Edited by Wm. Schooling, F.R.A.S.  
Another copy. *The Publishers.  
The Editor.*
- Italy.**  
Bolletino della Associazione Italiana per l'incremento  
della scienza Degli Attuari. *The Association.*
- Life Assurance Companies' Returns for 1898.** *Board of Trade.*
- Longman's Studies and Questions in Book-keeping and  
Advanced Accounts. With Notes and Answers by  
Alfred Nixon, F.C.A., F.S.A.A.** *The Publishers.*
- Newcastle-on-Tyne, Insurance Institute of.**  
Report 1896-97 and 1897-98. *Insurance Institute.*
- New South Wales.**  
Actuarial Society of—Rules. (3 copies.) *The Society.*  
Insurance Institute of—Sessional Proceedings. *The Institute.*
- Norman (John Henry).**  
The World's Exchanges in 1898. *The Author.*
- Parliamentary Papers.**
- Bills.
- Old Age Provident Pensions (31) and (87).  
Poor Law (60 and 61).  
Building Societies.  
Form of Annual Account and Statement.  
Returns, 1896 and 1897.  
Second Annual Report, Part I, 1897.  
Third Annual Report, Part I, 1898.
- Colonies.
- New South Wales.  
Statistical Register, 1897.  
Vital Statistics for 1897 and previous years.
- } *Purchased.*
- } *The Government  
of N.S.W.*

*By whom presented  
(when not purchased).*

Parliamentary Papers—(continued).

Colonies—(continued).

New Zealand.

Official Year Book, 1898.	<i>N. Z. Government.</i>
Old Age Pensions Act, 1898.	<i>Purchased.</i>
Statistics of the Colony of—1897.	<i>N. Z. Government.</i>
Twenty-second Annual Report by the Registrar of Friendly Societies.	<i>N. Z. Government.</i>

Victoria.

Statistical Register of the Colony of—1895 and 1896.	<i>The Government Statistician.</i>
Twentieth Annual Report of the Actuary for Friendly Societies for 1897.	<i>The Actuary for Friendly Societies.</i>

Friendly Societies.

Guide Book of the Registry Office, 1899.	<i>Purchased.</i>
Memorandum on Valuations of.	
Report of the Registrar, 1896. Parts A and B.	
"    "    "    1897. Part A.	
"    "    "    Part C, Appendix (M). 1897.	
"    1897. (Part II. Societies with Branches).	
"    1898.    "    "    "	
Reports, 1875–1895, Index to.	
Government Insurances and Annuities. Account 1898.	

National Debt. History of the Earlier Years of the Funded Debt. From 1694 to 1786.	<i>Alex. J. Finlaison, C.B.</i>
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National Debt. Return, 1897.

National School Teachers (Ireland) Pension Fund.  
Report, 1897.

Navy. Statistical Report of the Health of the—1896.

Old Age Pensions.

Report of, and Minutes of Evidence taken by, the  
Royal Commission on Aged Poor. In 3 vols.  
1895.

Report of the Committee on—1898.

Report from the Select Committee. 1899.

Report of the Board of Trade on the provision for  
Old Age abroad. 1899.

Registrar-General's Reports on Births, Deaths, and  
Marriages in England.

Fifty-eighth, Fifty-ninth, and Supplement to  
Fifty-fifth Annual Reports.

General Abstracts. 1896 and 1897.

Forty-first, Forty-second, and Forty-third Annual  
Reports (Scotland).

Thirty-third Annual Report (Ireland).

Savings Banks and Friendly Societies.

An Account for the Year ended 31st December, 1896.

Trustee Savings Banks.

Fifth Annual Report. 1896.

Return. 1896.

Vaccination Commission. Sixth Report. 1897.

Index to Final Report. 1898.

Workmen's Compensation Act, 1897.

"Application for Certificate to Scheme."

*By whom presented  
(when not purchased).*

## Periodicals.

Accountants' Magazine.	<i>Purchased.</i>
Institute of Bankers' Journal.	<i>The Institute.</i>
Insurance Record, 1898.	<i>The Editor.</i>
Insurance Register, 1899.	<i>C. &amp; E. Layton.</i>
Insurance Spectator of London, 1898.	<i>The Editor.</i>
London Mathematical Society's Journal.	<i>The Society.</i>
Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland.	<i>Purchased.</i>
Post Magazine.	<i>The Editor.</i>
Post Magazine Almanac.	<i>The Editor.</i>
Royal Statistical Society's Journal.	<i>The Society.</i>
Zeitschrift für Versicherungs-Recht Wissenschaft.	<i>The Editor.</i>

## Raleigh (Thomas), M.A.

An Outline of the Law of Property. 1890.	<i>Purchased.</i>
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## Root (J. W.).

Tariff and Trade. 1898.	<i>Purchased.</i>
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## Royal Astronomical Society.

Memoirs of the. Vols. 52 and 53.	<i>The Society.</i>
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## Schubert (Hermann).

Mathematical Essays and Recreations. From the German, by Thomas J. McCormack.	<i>Purchased.</i>
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## Society of Accountants and Auditors.

List of Members, 1899.	<i>The Society.</i>
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## Sprague (T. B.), M.A., LL.D., F.R.S.E.

On the Eight Queens Problem.	<i>The Author.</i>
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## Stephens, (W. Walker).

Old Age Annuities for Men and Women on a Scheme attractive to the Purchasers.	<i>The Author.</i>
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## Switzerland.

Rapport du Bureau Fédéral des Assurances sur les Enterprises Privées en Matière d'Assurances en Suisse en 1897.	<i>The Swiss Govern- ment.</i>
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## Technical Education Board.

Report of the Special Sub-Committee on Commercial Education. 1899.	<i>The Board.</i>
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Transactions of the Second International Actuarial  
Congress, held in London, May 16th to 20th, 1898.  
3 copies.

## Victoria, Insurance Institute of.

Report of Proceedings, Session 1898.	<i>The Insurance Institute.</i>
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## Whitaker's Almanac, 1899.

*Purchased.*

Yorkshire, Insurance Institute of.

Report, 1897-98.

*By whom presented  
(when not purchased).*

} *The Insurance  
Institute.*

Young (T. E.), B.A., F.R.A.S.

On Centenarians; and the duration of the Human  
Race.

*The Author.*

An additional copy of each of the under-mentioned works,  
already in the Library, has also been purchased.

Farr (William), M.D., F.R.S., D.C.L.

English Life Table, No. 3. 1864.

On the Construction of Life Tables, illustrated by a  
New Life Table of the Healthy Districts of  
England. 1859.

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OF  
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### FELLOWS.

*Those marked \*\*\* have passed the Examination for the Class of Fellow.*

Date of becoming a Fellow.	Date of becoming a Fellow.
1876***Ackland, Thomas Gans, F.S.S., Mem. Act. Soc. Amer., 10 Church-crescent, Muswell-hill, Highgate, N.	1885***Ansell, Hubert, London Scottish-American Trust, 75 Lombard-street, E.C.
1871***Addiscott, Francis, Medical Sickness, Annuity & Life Assur. Soc., 33 Chancery-lu., W.C.	1896***Archer, Joseph Alfred, Ecclesiastical Commission, 10 Whitehall-place, S.W.
1892 Adlard, Alfred Barton, Law Life Assur. Soc., 187 Fleet- street, E.C.	1850***Bailey, Arthur Hutcheson, F.S.S. (PAST PRESIDENT, 1878-82), 26 Mount Ephraim-rd, Streatham, S.W.
1864***Adler, Marcus Nathan, M.A., Alliance Assur. Co., Bartholo- mew-lane, E.C.	1896***Baker, Henry James, Metropolitan Life Assur. Soc., 13 Moorgate-street, E.C.
1894***Aldcroft, William Hancock, Refuge Assur. Co., Oxford-st., Manchester.	1885***Barnes, Joseph Howard, F.S.S., Pelican Life Insurance Co., 70 Lombard-street, E.C.
1889***Allen, Arthur Gregory, 13 Fairfax-road, N.W.	1895***Barrand, Arthur Rhys, Prudential Assurance Company, Holborn-bars, E.C.
1897***Allen, John Mayhew, Alliance Assur. Co., Bartholo- mew-lane, E.C.	1890***Bearman, Harry, Gresham Life Assur. Soc., St. Mildred's-house, Poultry, E.C.
1899***Allin, Samuel John Henry Wallis, Northern Assurance Company, 1 Moorgate-street, E.C.	1889***Bell, Frederick, Imperial Life Insurance Co., 1 Old Broad-street, E.C.
1889***Anderson, John, Lancashire Insurance Company, 18 Exchange-street, Manchester.	1867***Berridge, George William, Dunton-lgy., The Knoll, Becken- ham, Kent.
1891***Anderson, William Smith, Gresham Life Assurance Society, St. Mildred's-house, Poultry, E.C.	1886***Berry, Berry Alfred, B.A., London Life Association Ltd., 81 King William-street, E.C.
1885***Andras, Henry Walsingham, University Life Assur. Soc., 25 Pall Mall, S.W.	

## FELLOWS.

*Those marked \* have passed the Examination for the Class of Fellow.*

- | Date of becoming a Fellow.  | Date of becoming a Fellow.   |
|---|--|
| 1895***Besant, Arthur Digby, B.A.,<br><i>Clerical, Medical &amp; General Life Assur. Soc., 15 St. James's-square, S.W.</i>                | 1889***Chatham, James, F.F.A., F.S.S.,<br><i>Scottish Life Assurance Co., 19 St. Andrew-sq., Edinburgh.</i>                            |
| 1879 Besso, Marco, F.S.S.,<br><i>Superior Trade Council, Rome.</i>  | 1875 Cherriman, J. B., Prof., M.A.,<br><i>c/o The Bank of Montreal, Abchurch-lane, E.C.</i>  |
| 1894***Blackadar, Alfred Kimball, M.A.,<br><i>Mem. Act. Soc. Amer., Government Insur. Department, Ottawa, Canada.</i>                     | 1883 Chisholm, James, F.F.A., Mem. Act. Soc. Amer. (VICE-PRESIDENT),<br><i>Imperial Life Insurance Co., 1 Old Broad-street, E.C.</i>   |
| 1883***Blakey, James,<br><i>National Debt Office, 19 Old Jewry, E.C.</i>  | 1895***Clarke, Arthur Harold,<br><i>Clerical, Medical and General Life Assurance Society, 15 St. James's-square, S.W.</i>              |
| 1897***Bradshaw, Thomas, Mem. Act. Soc. Amer.,<br><i>The Imperial Life Assurance Co. of Canada, Toronto, Canada.</i>                      | 1863 Clirehugh, William Palin, F.S.S.,<br><i>London and Lancashire Life Assurance Company, 66 &amp; 67 Cornhill, E.C.</i>              |
| 1899***Brown, Edward Harold,<br><i>Prudential Assurance Company, Holborn-bars, E.C.</i>   | 1879 Cockburn, Henry, F.F.A., Mem. Act. Soc. Amer.,<br><i>North British and Mercantile Insurance Co., 61 Threadneedle-street, E.C.</i> |
| 1875 Browne, Thomas G. C.,<br><i>Guardian Assurance Company, 11 Lombard-street, E.C.</i>  | 1886 Cockburn, Henry Robertson, F.F.A.,<br><i>Scottish Provident Institution, 6 St. Andrew-sq., Edinburgh.</i>                         |
| 1887 Browne, Willis,<br><i>India Office, S.W.</i>   | 1898***Cockman, Arthur Charles Roadnight,<br><i>Liverpool and London and Globe Insurance Co., 7 Cornhill, E.C.</i>                     |
| 1899***Bull, Ernest James,<br><i>Atlas Assur. Co., 92 Cheapside, E.C.</i>   | 1884***Colenso, Francis Ernest, M.A.,<br><i>Eagle Insurance Company, 79 Pall-mall, S.W.</i>  |
| 1866***Bumsted, David Alexander,<br><i>General Reversionary and Investment Co., Ltd., 26 Pall-mall, S.W.</i>                              | 1864***Coles, John, F.S.S.,<br><i>39 Throgmorton-street, E.C.</i>  |
| 1894***Burn, Joseph,<br><i>Prudential Assurance Company, Holborn-bars, E.C.</i>   | 1882***Colquhoun, Ernest,<br><i>Legal and General Life Assur. Society, 10 Fleet-street, E.C.</i>                                       |
| 1881***Burridge, Arthur Francis, Mem. Act. Soc. Amer. (HON. SEC.),<br><i>Equity and Law Life Ass. Soc., 18 Lincoln's-inn-fields, W.C.</i> | 1875***Cooke, Thomas Homans,<br><i>Glendower, Teignmouth-road, Torquay.</i>  |
| 1887***Byers, Frederick Timothy Mason,<br><i>Clergy Mutual Assurance Soc., 2 &amp; 3 The Sanctuary, Westminster, S.W.</i>                 | 1889***Cooper, Walter George,<br><i>Norwich Union Life Insurance Society, Norwich.</i>   |
| 1888***Calderon, Henry Philip,<br><i>Institute of Actuaries, Staple-inn-hall, Holborn, W.C.</i>   | 1878***Crisford, George Stephen,<br><i>Rock Life Assurance Company, 15 New Bridge-street, E.C.</i>                                     |
| 1871***Carment, David, F.F.A., Mem. Act. Soc. Amer.,<br><i>Australian Mutual Provident Society, Sydney, Australia.</i>                    | 1889***Cross, Robert,<br><i>Atlas Assurance Company, 92 Cheapside, E.C.</i>  |

## FELLOWS.

Those marked \* have passed the Examination for the Class of Fellow.

Date of becoming a Fellow.		Date of becoming a Fellow.	
1864	Curtis, Frank Allan, 3 Ennismore-gardens, Salisbury-road, Dover.	1872	Eccles, Yvon Richard, Scottish Amicable Life Assurance Society, 1 Threadneedle-st., E.C.
1864	Cutcliffe, George, Coombe-house, Witheridge, North Devon.	1897***	Elder, Kenneth William, Atlas Assurance Company, 92 Cheapside, E.C.
Under the Charter.	Davies, Griffith, 11 Freeland-road, Ealing, W.	1898***	Elliott, Charles Alfred, Australian Mutual Provident Society, Sydney, Australia.
1898***	Dawson, Charles Pearl, Imperial Life Insurance Co., 1 Old Broad-street, E.C.	1889***	Faulks, Joseph Ernest, B.A., F.S.S., Law Life Assurance Society, 187 Fleet-street, E.C.
1855***	Day, Archibald (PAST PRESIDENT, 1886-88), Clifton-lodge, St. John's-park-road, Blackheath, S.E.	1897***	Fellows, Rowland Hill, F.S.S., British Empire Mutual Life Assurance Company, 4 & 5 King William-street, E.C.
1855***	Day, Stanley, Marine and General Mutual Life Assurance Society, 14 Leaden-hall-street, E.C.	1861***	Finlaison, Alexander John, C.B. (PAST PRESIDENT, 1894-96), Mem. Act. Soc. Amer., National Debt Office, 19 Old Jewry, E.C.
1897***	Day, William Reginald, The Standard Life Association, Ltd., 28 Elizabeth-street, Sydney, Australia.	Under the Charter.	Fisher, Richard Charles, 2 Walsingham-rd., W. Brighton.
1869	Denchar, David, F.F.A., F.R.S.E., Mem. Act. Soc. Amer., Caledonian Insurance Company, 19 George-street, Edinburgh.	1892***	Foot, Herbert, B.A., Northern Assurance Company, 1 Moorgate-street, E.C.
1883	Denchar, John Jas. Walker, F.F.A., Norwich Union Life Insurance Society, Norwich.	1884	Frankland, Frederick William, F.S.S., Mem. Act. Soc. Amer., New York Life Insurance Co., 346 & 348 Broadway, New York.
1882	Dewey, Thomas Charles, Prudential Assurance Company, Holborn-bars, E.C.	1897***	Fraser, Duncan Cumming, M.A., Royal Insurance Co., Liverpool.
1886***	Dickinson, Arthur Lowes, M.A., F.C.A., 19 Coleman-street, E.C.	1895***	Fulford, Frederick Wesley, Prudential Assurance Company, Holborn-bars, E.C.
Under the Charter.	Docker, Edward, M.A., Dudley-house, Spring-grove, Isleworth.	1887	Gillison, John Broth, F.F.A., National Mutual Life Association of Australasia, Corner of Collins and Queen-streets, Melbourne, Australia.
1887	Douglas, Gordon, F.F.A., Life Association of Scotland, 82 Princes-street, Edinburgh.	1878	Gordon, Charles, F.F.A., South African Mutual Life Assurance Society, Cape Town.
1875***	Duncan, James Heron, Royal Exchange Assurance Corp., Royal Exchange, E.C.	1882***	Graham, James, F.F.A., Australian Widows' Fund Life Assurance Society, Collins-street-west, Melbourne, Australia.
1874***	Duncan, John, Clergy Pensions Institution and Ecclesiastical Insurance Office, 11 Norfolk-street, Strand, W.C.	1886	Gunn, Niel Ballingal, F.F.A., Scottish Amicable Life Assurance Society, 35 St. Vincent-place, Glasgow.
1869	Dymond, Joseph John, Friends' Provident Institution, Bradford, Yorkshire.		



## FELLOWS.

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|----------------------------------|---|----------------------------------|---|
| 1864                             | Harben, Sir Henry,<br><i>Prudential Assurance Company,</i><br><i>Holborn-bars, E.C.</i>   | 1894***                          | Hutcheson, William Anderson,<br>F.F.A.,<br><i>London Assurance Corporation,</i><br><i>7 Royal Exchange, E.C.</i>  |
| 1880***                          | Hardy, George Francis,<br><i>Universal Life Assurance Soc.</i><br><i>1 King William-street, E.C.</i>  | 1893***                          | Hutton, William, F.F.A.,<br><i>Scottish Amicable Life Assur.</i><br><i>Soc., 1 Threadneedle-street, E.C.</i>  |
| 1870***                          | Hardy, Ralph Priece,<br><i>61 Addison-road, W.</i>  | 1869***                          | Justican, Edwin, F.S.S.,<br><i>Gresham Life Assurance Society,</i><br><i>St. Mildred's-house, Poultry, E.C.</i>   |
| 1893***                          | Harris, Arnold Stoughton, M.A.,<br><i>Clerical, Medical &amp; General Life</i><br><i>Assur. Soc., 15 St. James's-sq., S.W.</i>                                      | 1876***                          | Kember, Walter,<br><i>Scottish Amicable Life Assur.</i><br><i>Soc., 60 Castle-street, Liverpool.</i>  |
| 1892***                          | Hart, James Robert,<br><i>British Empire Mut. Life Assur.</i><br><i>Co., 4 &amp; 5 King William-st., E.C.</i>   | 1897***                          | Kentish, Owen,<br><i>Economic Life Assurance Soc.,</i><br><i>6 New Bridge-street, E.C.</i>  |
| 1879                             | Harvey, Chas. J.,<br><i>The Colonial Life Insee. Co. of</i><br><i>America, 43 Montgomery-street,</i><br><i>Jersey City, N.J., U.S.A.</i>                            | 1874***                          | King, George, F.F.A., Mem. Act.<br>Soc. Amer. (HON. EDITOR OF<br>JOURNAL),<br><i>London Assurance Corporation,</i><br><i>7 Royal Exchange, E.C.</i>   |
| 1888***                          | Hemming, Arthur George, F.S.S.,<br><i>13 New-sq., Lincoln's-inn, W.C.</i>   | 1887***                          | Kyd, Thomas, F.F.A.,<br><i>Northern Assurance Company,</i><br><i>1 Union-terrace, Aberdeen.</i>   |
| 1896***                          | Henderson, Robert, B.A.,<br><i>Equitable Life Assurance Soc.,</i><br><i>120 Broadway, New York.</i>   | 1876***                          | Laing, Francis, F.F.A.,<br><i>Northern Assurance Company,</i><br><i>1 Moorgate-street, E.C.</i>   |
| 1864                             | Hendriks, Augustus, F.S.S., Mem.<br>Act. Soc. Amer. (PAST PRESI-<br>DENT, 1892-94),<br><i>Liverpool and London and Globe</i><br><i>Insur. Co., 7 Cornhill, E.C.</i> | 1882                             | Lancaster, William John,<br><i>Prudential Assurance Company,</i><br><i>Holborn-bars, E.C.</i>   |
| Under<br>the<br>Charter.         | Hendriks, Frederick, F.S.S.,<br><i>7 Vicarage-gate, Kensington, W.</i>  | 1894***                          | Laughton, Alexander Millar, F.F.A.,<br><i>National Mutual Life Assoc. of</i><br><i>Australasia, Limited, Corner of</i><br><i>Collins and Queen-streets, Mel-</i><br><i>bourne, Australia.</i> |
| 1883                             | Hewat, Archibald, F.F.A., F.S.S.,<br><i>Edinburgh Life Assurance Co.,</i><br><i>22 George-street, Edinburgh.</i>  | 1887***                          | Lemon, William Kent, Barrister-<br>at-Law,<br><i>5 Pump-court, E.C.</i>   |
| 1874***                          | Higham, Charles Daniel, Mem.<br>Act. Soc. Amer. (TREASURER),<br><i>London Life Association Ltd.,</i><br><i>81 King William-street, E.C.</i>                         | 1896***                          | Levine, Abraham, M.A. (HON.<br>SUB-EDITOR OF JOURNAL).<br><i>National Mutual Life Assur.</i><br><i>Soc., 39 King-st., Cheapside, E.C.</i>   |
| 1898***                          | Hodgson, William Horsford,<br><i>Law Life Assurance Society,</i><br><i>187 Fleet-street, E.C.</i>   | 1896***                          | Lewis, John Norman, F.F.A.,<br><i>Scottish Widows' Fund Life</i><br><i>Assur. Soc., 28 Cornhill, E.C.</i>   |
| 1899***                          | Holliday, John, M.A.,<br><i>Institute of Actuaries, Staple-</i><br><i>inn-hall, Holborn, W.C.</i>   | 1892***                          | Lidstone, George James,<br><i>Alliance Assur. Co., Bartholo-</i><br><i>mew-lane, E.C.</i>   |
| 1888***                          | Hopkins, William Raynes,<br><i>London &amp; Lancashire Life Assur.</i><br><i>Co., 66 &amp; 67 Cornhill, E.C.</i>  | 1899                             | Low, George Macritchie, F.F.A.,<br><i>Edinburgh Life Assurance Co.,</i><br><i>22 George-street, Edinburgh.</i>  |
| 1890***                          | Hovil, Lewis Frederick,<br><i>National Provident Institution,</i><br><i>48 Gracechurch-street, E.C.</i>   | 1899***                          | Lutt, Harold Edward William,<br><i>Commercial Union Assur. Co.,</i><br><i>Ltd., 24, 25 &amp; 26 Cornhill, E.C.</i>  |
| 1871***                          | Hughes, William, Mem. Act. Soc.<br>Amer. (VICE-PRESIDENT),<br><i>Prudential Assurance Company,</i><br><i>Holborn-bars, E.C.</i>                                     |                                  |   |

## FELLOWS.

Those marked \*\*\* have passed the Examination for the Class of Fellow.

- | Date of<br>becoming<br>a Fellow.  | Date of<br>becoming<br>a Fellow.   |
|---|--|
| 1898***Macaulay, Thomas Bassett, Pres.<br>Act. Soc. Amer.,<br><i>Sun Life Assurance Co. of<br/>Canada, Montreal, Canada.</i>  | 1899***Moir, Henry, F.F.A.,<br><i>Scottish Life Assur. Co., 19 St.<br/>Andrew-square, Edinburgh.</i>                                     |
| 1885 Mackenzie, Alexander George,<br>F.F.A.,<br><i>Hillside, Marischal-rd., Lee, S.E.</i>   | 1890***Molyneux, Arthur Ernest,<br><i>Provident Clerks' Mutual Life<br/>Assurance Association, 27 &amp; 29<br/>Moorgate-street, E.C.</i> |
| 1870***Manly, Henry William, Mem. Act.<br>Soc. Amer. (PRESIDENT),<br><i>Equitable Life Assurance Soc.,<br/>Mansion-house-street, E.C.</i>   | 1897***Moors, Elphinstone MacMahon,<br>M.A.,<br><i>University of Sydney, Australia.</i>  |
| 1898***Marchbank, Frank, F.F.A.,<br><i>Royal Exchange Assur. Corp.,<br/>8 Mosley-st., Newcastle-on-Tyne.</i>  | 1896***Moran, Joseph Flack,<br><i>Marine &amp; General Mutual Life<br/>Assurance Society, 14 Leaden-<br/>hall-street, E.C.</i>           |
| 1890***Marks, Geoffrey (HONORARY<br>LIBRARIAN),<br><i>National Mutual Life Assur. Soc.,<br/>39 King-street, Cheapside, E.C.</i>   | 1895***Muter, Percy,<br><i>New Zealand Government Life<br/>Insurance Department Wel-<br/>lington, New Zealand.</i>                       |
| 1897***May, George Ernest,<br><i>Prudential Assurance Company,<br/>Holborn-bars, E.C.</i>   | 1888***Nash, Willie Oscar,<br><i>Law Reversionary Interest Soc.,<br/>Ltd., 24 Lincoln's-inn-fields, W.C.</i>                             |
| 1875 McCabe, William, LL.B., F.S.S.,<br>Mem. Act. Soc. Amer.,<br><i>North American Life Assur. Co.,<br/>North American Life Building,<br/>112-118 King-st.-west, Toronto,<br/>Canada.</i> | 1883 Neison, Francis G. P., F.S.S.,<br><i>19 Abingdon-st., Westminster, S.W.</i>   |
| 1874 McClintock, Emory, Mem. Act.<br>Soc. Amer.,<br><i>Mutual Life Insurance Company<br/>of New York, New York.</i>   | 1888***Newman, Philip Lewin, B.A.,<br><i>Yorkshire Insurance Co., York.</i>  |
| 1894***McDonald, John,<br><i>Prudential Assurance Company,<br/>Holborn-bars, E.C.</i>   | 1848 Newman, William Lewin,<br><i>22 St. Paul's-square, York.</i>  |
| 1864 McGedy, Frank,<br><i>Clifford Lodge, Crescent-road,<br/>Worthing.</i>  | 1865 Newton, Algernon, M.A.,<br><i>c/o London &amp; Westminster Bank,<br/>94 &amp; 96 High-st., Kensington, W.</i>                       |
| 1883***McGowan, James, B.A.,<br><i>The Treasury, Cape Town.</i>   | 1887***Nightingale, Harry Ethelston,<br><i>Royal Exchange Assurance Cor-<br/>poration, Royal Exchange, E.C.</i>                          |
| 1851***Meikle, James, F.F.A., Mem. Act.<br>Soc. Amer.,<br><i>Scottish Provident Institution,<br/>6 St. Andrew's-sq., Edinburgh.</i>   | 1899***Parker, Robert Peter,<br><i>Sun Life Assurance Society,<br/>63 Threadneedle-street, E.C.</i>                                      |
| 1897***Miller, Neville,<br><i>London Assurance Corporation,<br/>7 Royal Exchange, E.C.</i>  | 1864 Pearson, Arthur,<br><i>Betchworth-house, The Bank,<br/>Highgate, N.</i>   |
| 1864***Miller, Thomas,<br><i>Church-rd., West Kirby, Cheshire.</i>  | 1891***Phelps, William Peyton, M.A.,<br><i>Equity and Law Life Assur. Soc.,<br/>18 Lincoln's-inn-fields, W.C.</i>                        |
| 1893***Milner, John William,<br><i>North British &amp; Mercantile Insur.<br/>Co., 61 Threadneedle-street, E.C.</i>  | 1850***Porter, Henry William, B.A.,<br><i>73 Inverness-ter., Hyde-park, W.</i>   |
| 1892***Milton, Henry, M.A.,<br><i>37 Threadneedle-street, E.C.</i>  | Under<br>the<br>Charter.<br>Priestley, John George,<br><i>44 St. German's-road., Forest-<br/>hill, S.E.</i>                              |
|   | 1891***Pulley, William Pritchard,<br><i>Norwich Union Life Insur. Soc.,<br/>71 &amp; 72 King William-st., E.C.</i>                       |

## FELLOWS.

Those marked \*\* have passed the Examination for the Class of Fellow.

Date of becoming a Fellow.		Date of becoming a Fellow.	
1899***	Raisin, Arthur Herbert, <i>Pelican Life Office, 70 Lombard-street, E.C.</i>	1898***	Spencer, John, <i>English and Scottish Law Life Assurance Assoc., 12 Waterloo-place, S.W.</i>
1864	Ramsay, Alexander Gillespie, F.S.S., Mem. Act. Soc. Amer., <i>Canada Life Assurance Company, Hamilton, Canada.</i>	1894***	Sprague, Alfred Ernest, B.Sc., M.A., F.F.A., <i>Scottish Equitable Life Assur. Society, 26 St. Andrew-square, Edinburgh.</i>
1897***	Rees, Martin, <i>Law Reversionary Interest Soc., 24 Lincoln's-inn-fields, W.C.</i>	1857	Sprague, Thomas Bond, M.A., LL.D., F.F.A., F.S.S., F.R.S.E. (PAST PRESIDENT, 1882-86), Mem. Act. Soc. Amer., <i>Scottish Equitable Life Assur. Society, 26 St. Andrew-square, Edinburgh.</i>
1898***	Robinson, George Frederick, <i>Legal and General Life Assur. Society, 10 Fleet-street, E.C.</i>	1896***	Stahlschmidt, Louis, <i>Imperial Life Insurance Co., 1 Old Broad-street, E.C.</i>
1888***	Rusher, Edward Arthur, F.S.S., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	Under the Charter.	Stephenson, John Ware, 186 Clapham-road, S.W.
1882***	Ryan, Gerald Hemmington (VICE-PRESIDENT), Mem. Act. Soc. Amer., <i>British Empire Mutual Life Assurance Co., 4 &amp; 5 King William-street, E.C.</i>	Under the Charter.	Stevens, Charles, <i>Provident Life Assurance Co., 50 Regent-street, W.</i>
1898***	Salmon, Richard George, F.S.S., <i>Sun Life Assurance Society, 63 Threadneedle-street, E.C.</i>	1888	Stewart, John, F.F.A., <i>City of Glasgow Life Assur. Co., 30 Renfield-street, Glasgow.</i>
1883	Saunders, Harris Charter Lindon, F.R.A.S., 17 Gracechurch-street, E.C., and 95 Queen's-gate, S.W.	1898	Stirling, Robert, F.F.A., <i>Law Union &amp; Crown Insurance Co., 126 Chancery-lane, W.C.</i>
1886***	Schooling, Frederick (HONORARY LIBRARIAN), <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1868***	Strachan, Thomas Young, F.C.A., 1 Savoy-mansions, Savoy-st., W.C.
1896***	Sim, William Abernethy, F.F.A., <i>Scottish Union and National Insurance Co., 35 St. Andrew-square, Edinburgh.</i>	1892***	Straker, Edward Robert, <i>British Empire Mutual Life Assurance Co., 4 &amp; 5 King William-street, E.C.</i>
1886***	Simon, Louis Michael, <i>Metropolitan Life Assur. Society, 13 Moorgate-street, E.C.</i>	1878***	Straker, Frank Arthur, <i>Legal and General Life Assur. Society, 10 Fleet-street, E.C.</i>
1873	Slater, Duncan McLauchlan, <i>Oriental Government Security Life Assurance Company, Ltd., Oriental-buildings, Bombay.</i>	1884***	Stuart, John Moody, F.F.A., 16 St. Helen's-place, E.C.
1875***	Smither, Arthur, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>	1889***	Tarn, Arthur Wyndham, <i>Westminster and General Life Assurance Association, 28 King-street, Covent-garden, W.C.</i>
1881***	Somerville, William Finlay, <i>Liverpool and London and Globe Insur. Co., 1 Dale-st., Liverpool.</i>	1887	Teece, Richard, F.F.A., F.S.S., Mem. Act. Soc. Amer., <i>Australian Mutual Provident Society, Sydney, Australia.</i>
1877***	Sorley, James, F.F.A., C.A., F.R.S.E., <i>Pelican Life Insurance Company, 70 Lombard-street, E.C.</i>	1872	Templeton, Col. John M., C.M.G., <i>National Mutual Life Association of Australasia, Melbourne, Australia.</i>

## FELLOWS.

Those marked \* have passed the Examination for the Class of Fellow.

Date of becoming a Fellow.		Date of becoming a Fellow.	
1886	Tennant, John Bell, <i>Friends' Provident Institution,</i> <i>Bradford, Yorkshire.</i>	Under the Charter.	Tyndall, William Henry, F.S.S., F.R.Met.S., <i>Morlands, Oxford-road, Redhill,</i> <i>Surrey.</i>
1864***	Terry, James, <i>Hernlee, Lyme Regis, Dorset.</i>	1889	Wallace, Thomas, F.F.A., <i>North British &amp; Mercantile</i> <i>Insurance Co., Edinburgh.</i>
1889***	Thiselton, Herbert Cecil, F.F.A., Mem. Act. Soc. Amer., <i>Hand-in-Hand Insurance Soc.,</i> <i>26 New Bridge-street, E.C.</i>	1888***	Warner, Samuel George, <i>Law Union &amp; Crown Insur. Co.,</i> <i>126 Chancery-lane, W.C.</i>
1893***	Thomas, Ernest Charles, <i>Gresham Life Assurance Society,</i> <i>St. Mildred's-house, Poultry, E.C.</i>	1893***	Watson, Alfred William, <i>Manchester Unity Friendly Soc.,</i> <i>Nottingham.</i>
1899***	Thomas, Robert Arthur Caradoc, <i>British Empire Mutual Life</i> <i>Assur. Co., 4 &amp; 5 King William-</i> <i>street, E.C.</i>	1895***	Watson, James Douglas, <i>English &amp; Scottish Law Life Assr.</i> <i>Assoc., 12 Waterloo-place, S.W.</i>
1895***	Thomson, Herbert Archer, B.A. (HON. SUB-EDITOR OF JOURNAL) <i>Hand-in-Hand Insurance Soc.,</i> <i>26 New Bridge-street, E.C.</i>	1880***	Whittall, Wm. Joseph Hutchings, Mem. Act. Soc. Amer., <i>Clerical, Medical &amp; General Life</i> <i>Assur. Soc., 15 St. James's-sq., S.W.</i>
1880	Thomson, Robert, <i>Colonial Mutual Life Assurance</i> <i>Society, Collins - street - west,</i> <i>Melbourne, Australia.</i>	1864	Wilson, Robert, <i>44 Talfourd-rd., Camberwell, S.E.</i>
1876	Thomson, Spencer Campbell, B.A., F.F.A., <i>Standard Life Assurance Co.,</i> <i>George-street, Edinburgh.</i>	1888***	Wilson, Robert, Jun., <i>General Assurance Company,</i> <i>103 Cannon-street, E.C.</i>
1893***	Thorne, Alfred Charles, <i>Equity &amp; Law Life Assur. Soc.,</i> <i>18 Lincoln's-inn-fields, W.C.</i>	Under the Charter.	Winser, Thomas Boorman, <i>81 Shooter's-hill-road, Black-</i> <i>heath, S.E.</i>
1891***	Tilt, Robert Ruthven, <i>General Reversionary &amp; Invest-</i> <i>ment Co., Ltd., 26 Pall-mall, S.W.</i>	1899***	Winter, Arthur Thomas, <i>The British Empire Mutual Life</i> <i>Assurance Company, 1A Hare-</i> <i>street, Calcutta.</i>
1881***	Todd, George, M.A., <i>Economic Life Assurance Society,</i> <i>New Bridge-street, E.C.</i>	1897***	Wintle, Lancelot Andrewes, <i>Economic Life Assurance Soc.,</i> <i>6 New Bridge-street, E.C.</i>
1894***	Todhunter, Ralph, M.A., <i>National Mutual Life Assurance</i> <i>Society, 39 King-st., Cheapside,</i> <i>E.C.</i>	1884***	Woods, Ernest, Mem. Act. Soc. Amer. (HON. SECRETARY), <i>Westminster and General Life</i> <i>Assur. Assoc., 28 King-street,</i> <i>Covent-garden, W.C.</i>
1899***	Trouncer, Harold Moltke, B.A., <i>London Life Association Ltd.,</i> <i>81 King William-street, E.C.</i>	1875***	Wyatt, Frank Bertrand, Mem. Act. Soc. Amer. (VICE-PRESIDENT), <i>Clergy Mutual Assurance Soc.,</i> <i>2 &amp; 3 The Sanctuary, S.W.</i>
1878	Turnbull, Andrew Hugh, F.F.A., <i>Scottish Widows' Fund Life</i> <i>Assur. Soc., 9 St. Andrew-square,</i> <i>Edinburgh.</i>	1874	Young, Thomas Emley, B.A., F.R.A.S. (EX-PRESIDENT), Mem. Act. Soc. Amer., <i>Commercial Union Assur. Co.,</i> <i>Ltd., 24, 25 &amp; 26 Cornhill, E.C.</i>



## ASSOCIATES.

Those marked \* have passed the first of the three parts of the Examination for the Class of Fellow. Those marked \*\* have passed two of the three parts of the Examination for the Class of Fellow; those marked \*\*a or \*\*b, have also passed either Section A or Section B of Part III of the Examination.

Date of becoming an Associate.	Date of becoming an Associate.
1883** Adam, Harold Livingstone, 2 Versailles-road, Anerley, S.E.	1878** Bridgman, Arthur Henry, Equity & Law Life Assur. Soc., 18 Lincoln's-inn-fields, W.C.
1869** Adey, Theodore Henry, Scottish Provident Institution, 17 King William-street, E.C.	1899** Brown, Harold, City of Glasgow Life Assurance Co., 12 King William-street, E.C.
1899** <sup>a</sup> Adlard, Howard Tindale, A.K.C., The Equitable Life Assurance Society, Mansion-house-st., E.C.	1898** <sup>b</sup> Brown, Hugh Wyllie, F.F.A., Scottish Union & National Insur. Co., 35 St. Andrew-sq., Edinburgh.
1899** Adlard, Stanley, A.K.C., London Life Association Ltd., 81 King William-street, E.C.	1896 Brown, George Andrew, Clerical, Medical & General Life Assurance Society, 15 St. James's- square, S.W.
1899** Anderson, Thomas Frederic, Royal Exchange Assurance Cor- poration, Royal Exchange, E.C.	1898** Buchanan, James, M.A., Scottish Widows' Fund Life Assurance Society, 9 St. Andrew- square, Edinburgh.
1899** Ansell, George Frederic, National Debt Office, 19 Old Jewry, E.C.	1886 Buckley, Thomas John Wesley, 4 Wine Office-court, Fleet-street, E.C.
1898** Appleton, Frederick, London Life Association Ltd., 81 King William-street, E.C.	1882 Burke, David, F.S.S., Royal Victoria Life Insur. Co., Montreal, Canada.
1883** Ashley, John Geo., M.A., War Office, Pall Mall, S.W.	1895** Butterfield, William Thos., A.C.A., c/o Messrs. James and Edwards, 5 Coleman-street, E.C.
1881** Ayling, Charles Stephen, Commercial Union Assur. Co., 20 New Bridge-street, E.C.	1876* Carter, Eric Mackay, 33 Waterloo-street, Birmingham.
1885 Barton, Arthur, United Kent Insurance Institu- tion, Maidstone.	1896* Catchlove, Chas. Hamilton Leyland, Australian Mutual Provident Society, Adelaide, S. Australia.
1894** <sup>a</sup> Barton, Robert Whitchurch, Clerical, Medical & General Life Assurance Society, 15 St. James'- square, S.W.	1888 Churchward, George Gould, Clerical, Medical & General Life Assurance Society, Mansion- house-buildings, E.C.
1881 Birks, Edmund Alfred, Yorkshire Insurance Co., York.	1898** Coates, Thomas Linnaeus, North British and Mercantile Insurance Co., 61 Threadneedle- street, E.C.
1873** Block, Robert John, Essex - villa, Chelsham - road, Clapham, S.W.	1871 Cook, Arthur James, M.J.I., Victoria Mutual Assur. Society, Farringdon-street, E.C.
1898 Blount, Edward Thos. J., F.F.A., Standard Life Assurance Co., 3 Pall Mall East, S.W.	1899** <sup>b</sup> Cook, William Playfair, Guardian Assurance Company, 11 Lombard-street, E.C.
1869 Bools, William Edward, Liverpool and London and Globe Insurance Co., 7 Cornhill, E.C.	1878 Cooke, George, Commercial Union Assur. Co., Ltd., 24, 25 & 26 Cornhill, E.C.
1873** Boon, Gerald Inglis, Law Accident Insurance Society, 215 Strand, London.	1897** Coop, Charles Rowland, United Kingdom Temperance and General Provident Institution, 5 Bennett's-hill, Birmingham.
1861 Bourne, James Pearce, c/o Messrs. Lewis & Mounsey, 3 Lord Street, Liverpool.	
1889 Bremner, Thomas William, F.F.A., Mutual Life Insurance Co. of New York, Sydney, Australia.	



## ASSOCIATES.

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Date of becoming an Associate.		Date of becoming an Associate.	
1891**	Coote, Ernest Charles, <i>Alliance Assurance Company, Bartholomew-lane, E.C.</i>	1890	Fox, Charles Edward, F.F.A., <i>Standard Life Assurance Co., 83 King William-street, E.C.</i>
1897**a	Coutts, Charles Ronald Vawdrey, <i>Hand-in-Hand Insur. Society, 26 New Bridge-street, E.C.</i>	1886	Fox, Morris, Mem. Act. Soc. Amer., <i>New Zealand Government Life Insur. Dept., Wellington, N.Z.</i>
1871	Coutts, Edwin Arthur, <i>North British and Mercantile Insurance Company, Victoria- street, Nottingham.</i>	1898**b	Fraser, Alexander, Jr., F.F.A., <i>Edinburgh Life Assur. Company, 22 George-street, Edinburgh.</i>
1884	Craig, Robert Alexander, <i>Abstainers' and General Assur. Co., City Buildings, Birmingham.</i>	1894**	Fraser, Thomas John, <i>Australian Alliance Assurance Company, Melbourne, Australia.</i>
1884	Dell, Vincent John, <i>Equitable Life Assur. Society, Mansion-house-street, E.C.</i>	1873**	Gage, Uriah Woodard, <i>Universal Life Assur. Society, 1 King William-street, E.C.</i>
1855	Dix, James, <i>Hurstdale, Wood-la., Highgate, N.</i>	1897**	Galer, Frederic Bertram, B.A., <i>Rock Life Assurance Company, 15 New Bridge-street, E.C.</i>
1881	Donaldson, John, <i>Australian Widows' Fund Life Assurance Society, Collins-street- west, Melbourne, Australia.</i>	1895**	Galwey, Charles Edmund, <i>New Zealand Government Life Insurance Dept., Wellington, New Zealand.</i>
1899**	Dougharty, Harold, F.S.S., <i>London &amp; Lancashire Life Assur. Company, 66 &amp; 67 Cornhill, E.C.</i>	1893**	Gardiner, Robert Edward, <i>Sun Life Assurance Society, 63 Threadneedle-street, E.C.</i>
1881	Dovey, William Roadly, F.F.A., Mem. Act. Soc. Amer., <i>Citizens' Life Assurance Co., Castlereagh-st., Sydney, Australia</i>	1885**	Gayford, Herbert Stannard, <i>Northern Assurance Co., 15 Victoria-street, Nottingham.</i>
1870*	Dowson, John, <i>Royal Insur. Company, Liverpool.</i>	1897**	Gillies, George, <i>Union Ins. Soc., 81, Cornhill, E.C.</i>
1898**	Doyle, Arthur James, <i>Institute of Actuaries, Staple-inn- hall, Holborn, W.C.</i>	1871**	Glennie, William Gordon, <i>Scottish Union &amp; National Insur. Co., 3 King William-street, E.C.</i>
1868*	Eaton, Henry William, <i>Liverpool and London and Globe Insurance Company, William- street, New York, U.S.A.</i>	1895**a	Glover, Henry Walter, <i>41 Drayton-park, N.</i>
1899**	Elderton, William Palin, <i>Guardian Assurance Company, 11 Lombard-street, E.C.</i>	1897**	Goggs, Frank Sidney, <i>Scottish Metropolitan Life Assur. Co., 25 St. Andrew-sq., Edinburgh.</i>
1872**	Evans, William, F.F.A., F.R.S.E., <i>38 Morningside-park, Edinburgh.</i>	1882	Goldman, Leopold, <i>North American Life Assurance Co., North American Life Buildings, 112-118 King-street- west, Toronto, Canada.</i>
1896**	Featherstonelagh, William Irwin, <i>Commercial Union Assurance Co., 24, 25 &amp; 26 Cornhill, E.C.</i>	1897**	Goodwyn, John, Jun., <i>Norwich and London Accident Insurance Assoc., 1 Lakenham- terrace, Norwich.</i>
1897**	Findlay, Alexander Wynaud, LL.B., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1899	Gordon-Smith, Randolph, F.F.A., <i>Scottish Amicable Life Assur. Society, 35 St. Vincent-place, Glasgow.</i>
1881	Fisher, Frederick, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>		

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Date of becoming an Associate.	Date of becoming an Associate.
1888 Gray, John, <i>Scottish Widows' Fund Life Assur. Society, 28 Baldwin-st., Bristol.</i>	1898** Howell, Chas. Edward, B.A., LL.D., <i>Standard Life Assurance Comp., 66 Upper Sackville-st., Dublin.</i>
1898** Green, George, B.A., <i>Institute of Actuaries, Staple-inn-hall, W.C.</i>	1899** Hudson, Alfred James, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1868* Greig, John Andrew, <i>Sun Life Assurance Society, 60 Charing-cross, S.W.</i>	1875 Hunt, Richard Aldington, F.S.S., <i>Wesleyan &amp; General Assur. Soc., Corporation-street, Birmingham.</i>
1869 Griffith, E. Clifton, <i>4 Carlton-chambers, S.W.</i>	1893 Hunter, Arthur, F.F.A., <i>New York Life Insurance Co., 346 &amp; 348 Broadway, New York.</i>
1893** Hall, John Francis Edmund, <i>Eagle Insurance Company, 79 Pall-mall, S.W.</i>	1887** Hunter, Samuel, <i>Patriotic Assurance Company, 9 College-green, Dublin.</i>
1869 Hann, Robert George, Mem. Act. Soc. Amer., <i>The Equitable Life Assur. Soc., 120 Broadway, New York.</i>	1889 Jacobs, Frederick Job, <i>Australian Mutual Provident Society, Sydney, Australia.</i>
1894** Hardcastle, Edwd. Edgington, M.A., <i>Union Central Life Office, Cincinnati, U.S.A.</i>	1876** James, George Trevelyan, <i>12 Waterloo-place, S.W.</i>
1876* Harding, Harry Reginald, <i>Economic Life Assurance Soc., 6 New Bridge-street, E.C.</i>	1871 Jellicoe, George Rogers, <i>Eagle Insurance Company, 79 Pall-mall, S.W.</i>
1896**a Harris, Frederick Joseph, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1899** Jelly, Frank Edward, M.A., <i>36 George-street, Edinburgh.</i>
1897** Haycraft, William Melhuish, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1883 Jerman, Richard, <i>Commercial Union Assurance Company, Exeter.</i>
1897** Hazell, James Stanley, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>	1896** Jobson, Alexander, <i>Australian Mutual Provident Society, Melbourne.</i>
1895** Heness, Leonard Thomas, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1894** Johannessen, Nikolai Mikal, <i>Hygea Life Assurance Company, Bergen, Norway.</i>
1878 Henry, Alfred, F.C.A., <i>Throgmorton-house, Copthall-avenue, E.C.</i>	1894** Johnston, Frederick H., <i>Prudential Life Insurance Co., of America, Newark, N.J., U.S.A.</i>
1884 Higham, William Samuel, <i>Equitable Life Assurance Soc., Mansion-house-street, E.C.</i>	1870 Joyce, Septimus, <i>24 Bridge-street, Bristol.</i>
1894** Hollingworth, Albert Chas., <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1898** Kaufman, Henry N., Assoc. Act. Soc. Amer., <i>Phoenix Mutual Life Insurance Co., Hartford, Connecticut.</i>
1883 Holt, Edward Hallett, <i>Law Life Assurance Society, 187 Fleet-street, E.C.</i>	1876 Kearry, Joseph, <i>143 Broomwood-road, Wandsworth-common, S.W.</i>
1894** Home, Noel Charles Minchin, <i>L.L.B., F.S.S., Westcott, Dorking, Surrey.</i>	1899** Kelly, John Joseph, <i>Citizens' Life Assurance Co., Sydney, Australia.</i>
	1897** Kemp, Julian Ernest Sandford, <i>Eagle Insurance Company, 79 Pall-mall, S.W.</i>

## ASSOCIATES.

Those marked \* have passed the first of the three parts of the Examination for the Class of Fellow. Those marked \*\* have passed two of the three parts of the Examination for the Class of Fellow; those marked \*\*a, or \*\*b, have also passed either Section A or Section B of Part III of the Examination.

Date of becoming an Associate.	Date of becoming an Associate.
1858 Kilford, George William, <i>Rue de Grétry, Paris.</i>	1867* Macdonald, William Rae, F.F.A., <i>Scottish Metropolitan Life Assur. Co., 25 St. Andrew-sq., Edinburgh.</i>
1874* King, Arthur Thomas, <i>National Debt Office, 19 Old Jewry, E.C.</i>	1884 Mackay, Alexander, <i>Law Union &amp; Crown Fire &amp; Life Insur. Co., 126 Chancery-lane, W.C.</i>
1882** King, William Alfred, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>	1883* Mackenzie, Robert Kirkwood, <i>Norwich Union Fire Insurance Office, Norwich.</i>
1861 Knowles, Richard, <i>35 Tilson-road, Tottenham, N.</i>	1896** Macmillan, John Campbell, <i>Royal Insurance Co., Liverpool.</i>
1893** Laing, William Claud, <i>Pioneer Life Assurance Company, Ltd., 11 Dale-street, Liverpool.</i>	1895**a Maephail, Donald, F.F.A., <i>Yorkshire Insurance Company, York.</i>
1897** Lane, Arthur Vere, B.A., <i>Gresham Life Assurance Society, St. Mildred's-house, Poultry, E.C.</i>	1867 Macpherson, Ronald, <i>Law Union &amp; Crown Insurance Co., 126 Chancery-lane, W.C.</i>
1899** Lawton, George Herbert, <i>Clerical, Medical &amp; General Life Assur. Soc., 15 St. James's-sq., S.W.</i>	1883** Makeham, William Reed, <i>Imperial Life Insurance Co., 1 Old Broad-street, E.C.</i>
1885 Ledward, Archibald Prentice, B.Sc., <i>Scottish Provident Institution, 10 Albert-square, Manchester.</i>	1883 Mantering, George Willsher, <i>London &amp; Lancashire Life Assur. Co., 66 and 67 Cornhill, E.C.</i>
1879 Leitch, Alexander, <i>Scottish Provident Institution, 17 King William-street, E.C.</i>	1880* Manwaring, Henry, <i>National Debt Office, 19 Old Jewry, E.C.</i>
1897** Le Maitre, Frank William, <i>Sun Life Assurance Society, 63 Threadneedle-street, E.C.</i>	1898**a Marr, Vyvyan, F.F.A., <i>Edinburgh Life Assurance Co., 22 George-street, Edinburgh.</i>
1885 Leveaux, Arthur Michael, F.S.S., <i>Registry of Friendly Societies, Central Office, 28 Abingdon-street, Westminster, S.W.</i>	1878 Marshall, William, <i>South African Mutual Life Assur. Soc., Cape Town, South Africa.</i>
1885** Lidbury, Isaac Stephen, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1896** Martin, Sidney George, <i>National Mutual Life Assoc. of Australasia, Ltd., 150 Queen-street, Brisbane.</i>
1868* Litchfield, Edward, <i>Lancashire Insurance Company, 25 Pine-st., New York, U.S.A.</i>	1897** Mascal, Alfred John, <i>Standard Life Assurance Co., 83 King William-street, E.C.</i>
1897**a Little, James Fulton, <i>Mutual Life Association of Australasia, Sydney, Australia.</i>	1898** May, Basil, <i>Gilamont, Maple-road, Surbiton.</i>
1894**a Lowndes, Arthur, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>	1882** McDougald, Alfred, <i>British Empire Mutual Life Assur. Co., Montreal, Canada.</i>
1876** Lucey, Herbert, <i>General Assurance Company, 103 Cannon-street, E.C.</i>	1881 McKenzie, Duncan John <i>McGregor, New Zealand Government Life Insur. Department, Wellington, New Zealand.</i>
1890 Lugton, Hugh, F.F.A., <i>North British and Mercantile Insurance Co., 61 Threadneedle-street, E.C.</i>	

## ASSOCIATES.

Those marked \* have passed the first of the three parts of the Examination for the Class of Fellow. Those marked \*\* have passed two of the three parts of the Examination for the Class of Fellow; those marked \*\*a, or \*\*b, have also passed either Section A or Section B of Part III of the Examination.

Date of  
becoming an  
Associate.

- 1899\*\* Meade, Gerald Willoughby,  
*North British & Mercantile Insurance Company, 61 Thread-needle-street, E.C.*
- 1896\*\* Merfield, Percy Henry,  
*Law Life Assurance Society, 187 Fleet-street, E.C.*
- 1874 Miller, John W.,  
*Scottish Widows' Fund Life Assur. Soc., 28 Cornhill, E.C.*
- 1884 Mills, Daniel Yarnton,  
*Scottish Equitable Life Assur. Society, 26 St. Andrew-square, Edinburgh.*
- 1879\* Monilaws, William MacGeorge,  
*Scottish Provident Institution, 6 St. Andrew-sq., Edinburgh.*
- 1892\*\* Moodie, Peter Boyd,  
*Scottish Office, Whitehall, s.w.*
- 1877 Moon, James,  
*Prudential Assurance Company, 30 Dale-street, Liverpool.*
- 1877 Moon, John,  
*Prudential Assurance Company, 76 King-street, Manchester.*
- 1879\* Moon, Sidney Norman Laming,  
*The Fidelity and Casualty Co., 97-103 Cedar-street, New York.*
- 1898\*\* Moore, Joseph Patrick,  
*Citizens' Life Assurance Co., Sydney, Australia.*
- 1871\*\* Moore, Roderick Mackenzie,  
*United Kingdom Temperance and General Provident Institution, 1 Adelaide-place, London-bridge, E.C.*
- 1896\*\* Moorhouse, Alfred,  
*Friends' Provident Institution, Bradford.*
- 1897\*\*<sup>b</sup> Morgan, Benjamin Charles,  
*Commercial Union Assur. Co., 24, 25 & 26 Cornhill, E.C.*
- 1893\*\* Munro, Donald Alexander,  
*Africa House, 44-46 Leadenhall-street, E.C.*
- 1897\*\* Newling, Sidney Wallis, B.A.,  
*Woodleigh, South Woodford, Essex.*

Date of  
becoming an  
Associate.

- 1884 Nicoll, John, F.F.A.,  
*Life Association of Scotland, 82 Princes-street, Edinburgh.*
- 1897\*\* Norris, Charles Arthur,  
*National Mutual Life Assoc. of Australasia, Ltd., Melbourne, Australia.*
- 1883 Orr, Lewis P., F.F.A.,  
*Scottish Life Assur. Co., Ltd., 19 St. Andrew-sq., Edinburgh.*
- 1886 Owen, Evan Frederick, F.S.S.,  
*Office of the Actuary for Friendly Societies, Melbourne, Australia.*
- 1895\*\* Pagden, Lionel King (AUDITOR),  
*Union Insurance Society, 81 Cornhill, E.C.*
- 1878 Palmer, James William,  
*Belsize, Sutherland-road, Ealing, W.*
- 1864 Panton, Edward Henry,  
*Standard Life Assurance Co., 83 King William-street, E.C.*
- 1895\*\* Paradise, William Henry,  
*Australian Mutual Provident Society, Sydney, Australia.*
- 1869\* Park, David Francis, C.A., F.F.A.,  
*Crédit Foncier of Mauritius (Limited), 39 Lombard-st., E.C.*
- 1884 Park, Leslie John,  
*Colonial Mutual Life Assurance Society, Melbourne, Australia.*
- 1882\*\* Paterson, William Brockie, F.F.A.,  
*Mem. Act. Soc. Amer., Norwich Union Life Insurance Society, Norwich.*
- 1898 Pearee, Henry John, F.F.A.,  
*Edinburgh Life Assurance Co., 122 St. Vincent-street, Glasgow.*
- 1899\*\* Peele, Thomas,  
*Refuge Assurance Company, Oxford-street, Manchester.*
- 1875 Perratt, William Henry,  
*4 Finsbury-circus, E.C.*
- 1895 Pierson, Israel Coriell, Mem. Act. Soc. Amer.,  
*141 Broadway, New York, U.S.A.*
- 1899\*\* Pipe, Sidney Herbert,  
*Pearl Life Assurance Company, London-bridge, E.C.*



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Date of becoming an Associate.		Date of becoming an Associate.	
1883	Pitts, Thomas, <i>Commercial Union Assurance Company, Exeter.</i>	1879	Roberts, Thomas B., <i>Australian Alliance Assurance Company, Collins-street, Melbourne, Australia.</i>
1876*	Pound, Thomas James, <i>Clerical, Medical &amp; General Life Assurance Soc., 15 St. James's-square, S.W.</i>	1878	Robertson, William, F.F.A., <i>54 Queen-street, Edinburgh.</i>
1880	Povab, Charles, <i>Lancashire Insur. Co., Exchange-st., St. Ann's-square, Manchester.</i>	1876*	Robinson, Andrew, <i>Sunningdale-park, Sunningdale, Berks.</i>
1890**	Powell, Alfred, <i>Alliance Assurance Company, Bartholomew-lane, E.C.</i>	1885	Ronald, Thomas Robert, <i>Law Guarantee and Trust Soc., Ltd., 49 Chancery Lane, W.C.</i>
1881*	Price, William John, <i>Life Association of Scotland, 5 Lombard-street, E.C.</i>	1897**	Ryley, Edmund, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1869*	Pringle, James, C.A., F.F.A., <i>42 Drumsheugh-gardens, Edinburgh.</i>	1899**	Salter, Charles Henry, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>
1884	Pullar, James, F.F.A., <i>Colonial Mutual Life Assurance Society, Melbourne, Australia.</i>	1896**	Sanderson, Frank, M.A., Mem. Act. Soc. Amer., <i>Canada Life Assurance Company, Toronto, Canada.</i>
1881	Purves, Thomas Peter, <i>New York Life Insurance Company, Sydney, Australia.</i>	1884	Schooling, John Holt, <i>Fotheringay-house, Montpelier-row, Twickenham.</i>
1899**	Rae, Joseph, <i>Finance Department, Vestry-hall, Upper-street, N.</i>	1899**	Schouten, Pieter, <i>Algemeene Maatschappij van Levensverzekering en Lijfrente, Damrak, 74 Amsterdam.</i>
1867	Ratray, Patrick, C.A., <i>Gresham House, 45 West Nile-street Glasgow.</i>	1873	Scott, Ernest Willem, Mem. Act. Soc. Amer., <i>Algemeene Maatschappij van Levensverzekering en Lijfrente, Damrak, 74, Amsterdam.</i>
1874**	Ray, Charles Richard, <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>	1895**	Searle, George Morley, <i>Sun Life Assurance Society, 63 Threadneedle-street, E.C.</i>
1885*	Rea, Charles Herbert Edmund, F.R.A.S., F.S.S. (AUDITOR), <i>Pearl Life Assurance Company, London-bridge, E.C.</i>	1861**	Searle, Thomas John, <i>Mansion-house-chambers, Bucklersbury, E.C.</i>
1894**a	Reeve, Charles Ernest, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>	1891**a	Sheppard, Herbert Norman, B.A., <i>Institute of Actuaries, Staple-inn-hall, Holborn, W.C.</i>
1898**	Reid, Edward E., B.A., <i>London Life Insurance Co., London, Ontario.</i>	1899**	Sherriff, Francis Henry, <i>Provident Clerks' Mutual Life Assurance Association, 27 &amp; 29 Moorgate-street, E.C.</i>
1897	Richardson, Josephus Hargreaves, F.F.A., Mem. Act. Soc. Amer., <i>New Zealand Government Life Insurance Department, Wellington, New Zealand.</i>	1897**	Shimmell, James Edward, <i>23 Heron-road, Herne-hill, S.E.</i>
		1896**	Shlager, Joseph, <i>Mutual Assurance Society, Melbourne, Australia.</i>



## ASSOCIATES.

Those marked \* have passed the first of the three parts of the Examination of the Class of Fellow. Those marked \*\* have passed two of the three parts of the Examination for the Class of Fellow; those marked \*\*a, or \*\*b, have also passed either Section A or Section B of Part III of the Examination.

Date of becoming an Associate.		Date of becoming an Associate.	
1897**	Slade, Henry, 24 Durand-gardens, Clapham-road, S.W.	1899**	Symmons, Frank Percy, Prudential Assurance Company, Holborn-bars, E.C.
1864*	Smith, Howard Samuel, F.F.A., F.S.S., F.C.A., Bank-chambers, 14 Waterloo-street, Birmingham.	1882	Tarn, Walter George, Reversionary Interest Society, 30 Coleman Street, E.C.
1898**	Smith, Robert Parker, Lancashire Insurance Company, 18 Exchange-street, Manchester.	1893**	Taylor, Arthur, Westminster and General Life Assurance Assoc., 28 King-street, Covent-garden, W.C.
1884	Smithett, Edward Henry, "Hillside," Fitzroy-park, Highgate, N.	1875	Taylor, J. Wilford, North British and Mercantile Insur. Co., 61 Threadneedle-st., E.C.
1863**	Smyth, Edward, 52 Wiltshire-road, Brixton, S.W.	1895**a	Thodey, Robert, Australian Mutual Provident Society, Sydney, Australia.
1871	Spencer, Robert James, F.S.S., 75 King's-road, Southsea.	1898**	Thompson, Thomas Percy, B.A., Institute of Actuaries, Staple-inn-hall, Holborn, W.C.
1868	Spens, William George, Scottish Amicable Life Assur. Soc., 35 St. Vincent-pl., Glasgow.	1899**	Tinner, Thomas, Comptroller's Depart., London County Council, Spring-gardens, S.W.
1881	Stanciliffe, Frederick, British Empire Mutual Life Assurance Company, Montreal.	1883**	Titmuss, Walter George, Provident Life Assurance Co., 50 Regent-street, W.
1860*	Stark, James, F.S.S., Reversionary Interest Society, 30 Coleman-street, E.C.	1883*	Tregaskis, George Alfred, Hand-in-Hand Assurance Soc., 26 New Bridge-street, E.C.
1866	Stark, William Emery, F.S.S., Chapel-walks, Manchester.	1894**	Trenerry, Charles Farley, B.A., A Sul America Cia de Seguros de Vida, 971 Caixa do Correio, Rio de Janeiro.
1878	Stevenson, Charles, 9 Albert-square, Manchester.	1869**	Trew, Edward Bellingham, Law Life Assurance Society, 187 Fleet-street, E.C.
1880	Stock, Edward James, National Mutual Life Assoc. of Australasia, Melbourne, Australia.	1891**	Turnbull, A. D. Lindsay, C.A., F.F.A., Caledonian Insurance Company, 19 George-street, Edinburgh.
1895**	Strong, William Richard, London Guarantee & Accident Co., 61 Moorgate-street, E.C.	1877**	Turpin, William Gibbs, National Debt Office, 19 Old Jewry, E.C.
1898**	Stuckey, Edward Joseph, B.Sc., Australian Mutual Provident Society, Adelaide, S. Australia.	1884	Vian, William Collett, Railway Passengers' Assurance Company, 64 Cornhill, E.C.
1896**	Stuckey, Jos. James, M.A., Salisbury Chambers, 49a King William-street, Adelaide, South Australia.	1884	Vincent, Frederick James, F.S.S., London, Edinburgh & Glasgow Assurance Co., Ltd., Insurance-buildings, Farringdon-street, E.C.
1869	Surrenne, David John, F.F.A., Caledonian Insurance Company, 19 George-street, Edinburgh.		
1898**	Sutherland, John, M.A., Temperance & General Mutual Life Assur. Soc., Swanston-street, Melbourne, Australia.		

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Date of becoming an Associate.	Date of becoming an Associate.
1899** Vokins, George Alfred, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1870** Wilson, Henry Edward, <i>Northern Ass. Co., 1 Moorgate-street, E.C.</i>
1883** Walker, Davidson, F.F.A., <i>Norwich Union Life Assurance Society, Norwich.</i>	1873** Windett, Charles, <i>Legal &amp; General Life Assur. Soc., 10 Fleet-street, E.C.</i>
1879* Wall, Walter George, <i>Pymont, Prenton-road-west, Birkenhead.</i>	1882* Wingfield, John Tutin, <i>Law Union and Crown Insur. Co., 126 Chancery-lane, W.C.</i>
1878 Walton, William Gandy, F.F.A., <i>Scottish Provident Institution, 6 St. Andrew-square, Edinburgh.</i>	1898** Wood, Arthur Barton, B.A., Asso. Act. Soc. Amer., <i>Sun Life Assurance Co. of Canada, Montreal, Canada.</i>
1862* Waterhouse, Edwin, M.A., F.C.A., F.S.S., <i>3 Frederick's-place, Old Jewry, E.C.</i>	1883 Woodhouse, Lister, A.C.A., <i>Borough Treasurer, Town-hall, Birkenhead.</i>
1883** Watson, John Robertson, <i>British Law Fire Insurance Co., 176 West George-st., Glasgow.</i>	1877** Woods, Arthur Biddle, <i>Rock Life Assurance Company, 15 New Bridge-street, E.C.</i>
1887 Watson, Reuben, <i>Manchester Unity Friendly Soc., Nottingham.</i>	1866 Woods, Bernard, <i>Metropolitan Life Assur. Soc., 13 Moorgate-street, E.C.</i>
1894** Watt, George, <i>Royal Insurance Co., Liverpool.</i>	1875 Woods, Edward, <i>Victoria Life and General Insur. Co., Market-street, Collins-street-West, Melbourne, Australia.</i>
1883* Weall, Bertram, <i>City of Glasgow Life Assurance Co., 12 King William-street, E.C.</i>	1897** Woolfe, Archibald William, B.A., <i>4 Gainsborough-road, Leytonstone, E.</i>
1899** Weatherill, Henry, <i>National Debt Office, 19 Old Jewry, E.C.</i>	1898** Woolmer, Alfred Henry, <i>Star Life Assurance Society, 32 Moorgate-street, E.C.</i>
1894 Weeks, Rufus Wells, Mem. Act. Soc. Amer., <i>New York Life Insurance Co., 346 &amp; 348 Broadway, New York.</i>	1898** Workman, William Arthur, <i>Imperial Life Office, 9 &amp; 10 King-street, Cheapside, E.C.</i>
1898**a Whigham, Charles Frederick, F.F.A., <i>Scottish Provident Institution, 6 St. Andrew-square, Edinburgh.</i>	1879* Wornum, Thornton Selden, <i>Rock Life Assurance Company, 15 New Bridge-street, E.C.</i>
1884 Whyte, Alexander, <i>London Assurance Corporation, 40 Pall Mall, S.W.</i>	1893** Wright, Robert Young Murray, M.A., <i>Royal Insurance Co., Charing-cross, Birkenhead.</i>
1897** Wickens, Charles H., <i>Registrar-General's Office, Perth, W. Australia.</i>	1871 Yardley, John, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1896** Wilkinson, Edward Berkeley, <i>12 Highlever-road, N. Kensington, W.</i>	1873 Young, Alexander Hunter, <i>60 Market-street, Melbourne, Australia.</i>

## STUDENTS.

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Date of becoming a Student.		Date of becoming a Student.	
1892*	Aaron, David Hyam, <i>Sun Life Assurance Society, 63 Threadneedle-street, E.C.</i>	1891*	Barker, George, <i>National Provincial Bank of England, Dartmouth.</i>
1892*	Adams, Cecil Francis, <i>Scottish Metropolitan Life Assur. Co., Grey-st., Wellington, New Zealand.</i>	1899*	Barnett, Isaac, <i>11 Montague Houses, White-chapel, E.</i>
1894*	Anderson, Adam Thomson, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1899*	Barrett, William Goodsman, <i>Avoca, Seabank-road, Liscard.</i>
1886	Arnold, Thomas, Jun., <i>British Equitable Life Assurance Company, Queen-street-place, E.C.</i>	1896*	Barry, David, <i>Office of the Actuary for Friendly Societies, Melbourne, Australia.</i>
1896*	Ashley, Charles Henry, <i>Refuge Assurance Company, Oxford-street, Manchester.</i>	1897*	Benjamin, Stanley O., <i>Australian Mutual Provident Society, Melbourne.</i>
1897*	Ashton, William Richard, <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>	1898*	Bennell, Samuel Thomas, <i>20 Narford-road, Brooke-road, Clapton, N.E.</i>
1893*	Askew, Sydney J., <i>"Oakdene," 49 Park-road, Forest-hill, S.E.</i>	1898	Bennett, Samuel, <i>6 Gray-street, Workington.</i>
1896	Auehterlonie, Alexander Douglas, <i>Acme Insurance Co., Limited, Mowbray-house, 14 Norfolk-st., Strand, W.C.</i>	1895*	Bigby, Robert Frederick Mitchell, <i>General Assurance Company, 103 Cannon-street, E.C.</i>
1893**a	Austin, Herbert Henry, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1891*	Bird, Edward William, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1899*	Baber, Walter Crosbie, <i>Sun Life Assurance Co. of Canada, Montreal</i>	1898	Bishop, Harold Garfield, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1897*	Backett, William Albert, <i>Employers' Liability Assurance Corporation, 84 King William-street, E.C.</i>	1898*	Blake, Frederick Edward, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1898*	Bacon, James, <i>Institute of Actuaries, Staple-inn-hall, Holborn, W.C.</i>	1898*	Blake, Henry Prince, <i>Union Assurance Society, 81 Cornhill, E.C.</i>
1896*	Ball, Sidney Robertson, <i>English and Scottish Law Life Assurance Association, 12 Waterloo-place, S.W.</i>	1898*	Blake, Robert Walter Austin, <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>
1897	Barfield, Edmund John, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1895	Blanch, Frederick William, <i>Mutual Life Insurance Company of New York, 17 &amp; 18 Cornhill, E.C.</i>
		1887	Blossom, James, <i>186 South-view-road, Sheffield.</i>

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Date of becoming a Student.		Date of becoming a Student.	
1892*	Boddy, Henry Mitchell, <i>Imperial Life Assurance Co., 58 Sparks-st., Ottawa, Canada.</i>	1897*	Chandler, Thomas Richard, <i>London Assurance Corporation, 7 Royal Exchange, E.C.</i>
1897	Bond, Frederic D., <i>413 South 44th Street, Philadelphia, U.S.A.</i>	1899*	Cherry, Christopher F., <i>Citizens' Life Assurance Co., Sydney, Australia.</i>
1897*	Bowles, Francis Marsh, <i>Pearl Life Assurance Company, London Bridge, E.C.</i>	1894	Child, Frank Edward, <i>76 Hampton-road, Handsworth, Birmingham.</i>
1891*	Boyd, Henry Norris, <i>City of Glasgow Life Assurance Co., 21 St. Andrew-square, Edinburgh.</i>	1893	Chisholm, Daniel Henry, J.P., <i>7 Arundel-terrace, Forest-lodge, Sydney, Australia.</i>
1899*	Brady, John Francis, <i>Citizens' Life Assurance Co., Sydney, Australia.</i>	1891*	Claridge, William, M.A., <i>London and Midland Bank-chambers, Bradford.</i>
1897	Brierley, William Ernest, <i>Refuge Assurance Company, Oxford-street, Manchester.</i>	1897	Clark, Beauchamp, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1893*	Briggs, Frederick William, <i>Carton-villa, Wood-green, N.</i>	1897*	Clinton, George, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1894*	Brough, Frank, <i>Federal Life Assurance Company, Hamilton, Ontario.</i>	1895	Cogar, William Edward, <i>New York Life Insurance Co., Trafalgar-square, W.C.</i>
1891*	Brown, William Heron, <i>Gresham Life Assur. Soc., Ltd., St. Mildred's-house, Poultry, E.C.</i>	1898*	Collier, Charles Aubrey, <i>46 Crockerton-road, Tooting, S.W.</i>
1889	Buckle, Frederick, <i>68 Belleville-road, Wandsworth-common, S.W.</i>	1895**	Collins, Frank Lakeman, <i>Clerical, Medical &amp; General Life Assurance Soc., 15 St. James's-square, S.W.</i>
1899*	Buckler, William Peach, B.A., <i>2 Collingham-gardens, South Kensington, W.</i>	1899*	Collins, Patrick A., <i>Citizens' Life Assurance Co., Sydney, Australia.</i>
1899*	Burdett, Horace Rowsell, <i>75 High-street, Poplar, E.</i>	1891	Colvin-Smith, Colvin Arthur Edward, <i>North British and Mercantile Insurance Co., 61 Threadneedle-street, E.C.</i>
1899*	Burnley, Isaac, <i>Australian Mutual Prov. Society, Wellington, New Zealand.</i>	1892	Connolly, Edward, <i>Australian Mutual Provident Society, Sydney, Australia.</i>
1898	Campbell, Walter M., <i>North American Life Assur. Co., 112-118 King-street-west, Toronto, Canada.</i>	1896*	Cook, Henry Milton, <i>Standard Life Assurance Co., 3 George-street, Edinburgh.</i>
1896	Carr, Stanley T., <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1898*	Corbett, Edwin Somerville, <i>Colonial Mutual Life Assurance Society, Melbourne.</i>
1899*	Carter, Norman John, <i>London, Edinburgh &amp; Glasgow Assur. Co., Farringdon-st., E.C.</i>		



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Date of becoming a Student.		Date of becoming a Student.	
1899*	Cotterill, William Ernest, <i>Mutual Life Assoc. of Australasia, Ltd., Sydney, Australia.</i>	1896	Daughtrey, William Lamb, Jun., <i>Life Insurance Co. of Virginia, Richmond, Virginia, U.S.A.</i>
1897*	Court, Alexander George Dacus, <i>4 Langdale-road, Greenwich, S.E.</i>	1896*	Davey, Clarence, <i>Pearl Life Assurance Company, London-bridge, E.C.</i>
1886**	Covington, Oliver Henry, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1889*	Davies, Hugh Myddelton, <i>Royal Insurance Co., Liverpool.</i>
1896	Cox, Charles, <i>Mutual Life Insurance Co. of New York, 17 &amp; 18 Cornhill, E.C.</i>	1899*	Davison, Horace William, <i>222 Robert-st., Toronto, Canada.</i>
1894	Cox, Edward William, <i>Canada Life Assurance Co., Toronto, Canada.</i>	1891*	Dawson, Frank Aubrey, <i>Ecclesiastical Insurance Office, Ltd., Norfolk-st., Strand, W.C.</i>
1894	Cox, Herbert Coplin, <i>Canada Life Assurance Co., Toronto, Canada.</i>	1899*	De Lury, George, <i>Imperial Life Assurance Co. of Canada, Toronto, Canada.</i>
1896	Critchley, George Francis, <i>18 Handen-road, Lee, S.E.</i>	1896*	de Ville, Francis, <i>Clergy Pensions Institution, 11 Norfolk-street, Strand, W.C.</i>
1895*	Cross, Eustace Philip, <i>Commercial Union Assur. Co., 24, 25 &amp; 26 Cornhill, E.C.</i>	1896**	Diamond, George Frederick, <i>Australian Mutual Provident Society, Sydney, Australia.</i>
1887*	Cross, Henry John, <i>3 Park-rd., Wandsworth-common, S.W.</i>	1897*	Dick, William Thos., B.A., M.L.A., <i>Newcastle, N.S.W.</i>
1897*	Cross, Howard Turner, <i>Economic Life Assurance Soc., 6 New Bridge-street, E.C.</i>	1895*	Dickinson, Frank Ridley, <i>Peterborough-house, Harrow-on-the-Hill.</i>
1897*	Crump, Percy C., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1890*	Docker, Leslie, <i>North British and Mercantile Insurance Co., 61 Threadneedle-street, E.C.</i>
1897*	Culley, Alfred Benjamin, <i>Star Life Assurance Society, 32 Moorgate-street, E.C.</i>	1897*	Donaldson, James Stuart, <i>Mutual Life Association of Australasia, Ltd., Sydney, Australia.</i>
1897**	Curjel, H. W., M.A., <i>Royal Insurance Co., Liverpool.</i>	1897*	Dorrian, John Christopher, <i>Citizens' Life Assurance Company, Sydney, Australia.</i>
1895*	Curtis, William Allen, <i>Clerical, Medical &amp; General Life Assurance Society, 15 St. James's-square, S.W.</i>	1899*	Douglas, J. Joseph, <i>Irish Land Commission, 24 Upper Merrion-street, Dublin.</i>
1897*	Dalton, John, <i>London Life Association Ltd., 81 King William-street, E.C.</i>	1893*	Doust-Smith, Ernest Charles, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1891	Daniell, Ferrers Aitken, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>	1897**	Dunn, Spencer Græme, <i>National Mut. Life Assur. Soc., 39 King-street, Cheapside, E.C.</i>



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Date of becoming a Student.		Date of becoming a Student.	
1897*	Dunn, Walter James, <i>Citizens' Life Assurance Company, Sydney, Australia.</i>	1890	Gamman, Robert Ebenezer, <i>London Joint Stock Bank, Princes-street, E.C.</i>
1899*	Earle, Arthur Percival, <i>North American Life Assur. Co., North American Life Building, 112-118 King-st. West, Toronto, Canada.</i>	1886	Garcke, Emile, F.S.S., M.I.E.E., <i>Donington-house, Norfolk-street, W.C.</i>
1897*	Eeroyd, Cuthbert W., <i>Friends' Provident Institution, Bradford.</i>	1898**	Gibson, J. Paul S. R., <i>St. Cloud, Paris.</i>
1891	Edlmann, Herbert Elliot, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>	1899*	Giles, Hylton Lloyd, <i>British Empire Mutual Life Assurance Co., 4 &amp; 5 King William-street, E.C.</i>
1892	Edwards, Edward Samuel, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1895*	Gill, James Stewart, <i>Australian Widows' Fund Life Assur. Soc., Melbourne, Australia.</i>
1892*	Eedy, Arthur Malcolm, <i>Citizens' Life Assurance Company, Sydney, Australia.</i>	1893	Glasson, George Cornish, <i>Economic Life Assurance Soc., 4 St. Stephen's-chbrs., Baldwin-street, Bristol.</i>
1893*	Emery, John M., <i>The Security Trust &amp; Life Insur. Co., Tenth &amp; Chestnut-streets, Philadelphia.</i>	1893*	Gledstone, W. L., <i>Royal Exchange Assur. Corporation, Royal Exchange, E.C.</i>
1892*	Farrell, John, <i>Citizens' Life Assur. Co., 210 Queen-st., Brisbane, Australia.</i>	1897*	Goddard, Egbert, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1886	Fells, John Manyer, F.S.S., <i>85 Gracechurch-street, E.C.</i>	1897	Golby, Maurice Edward, <i>7 Playfair-mansions, W. Kensington, W.</i>
1893	Finlaison, Dudley Glen, <i>Sun Life Assurance Society, 60 Charing Cross, S.W.</i>	1894*	Golding, Arthur, <i>41 Digby-rd., Finsbury-park, N.</i>
1887	Fisher, Hugh Strettell, <i>1 Avoca-terrace, Blackrock, co. Dublin.</i>	1888*	Gooding, Harold John, <i>Law Guarantee and Trust Soc., Ltd., 56 Moorgate-street, E.C.</i>
1892	Fisher, Walter Churchill, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1892	Gordon, Alexander, <i>168 Islington, Liverpool.</i>
1869*	Fisk, George William Victor, F.S.S., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1896*	Gordon, Harry Duncan Lockhart, <i>221 George-st., Toronto, Canada.</i>
1898*	FitzGerald, William George, <i>London &amp; Lancashire Life Assurance Co., 164 St. James'-st., Montreal.</i>	1897**	Gosset, Thorold, <i>21 Old-bldgs., Lincoln's-inn, W.C.</i>
1897	Flint, William Charles, <i>Sun Life Office, 63 Threadneedle-street, E.C.</i>	1886	Gover, Frederick Field, F.S.S., <i>10 Lee-park, Blackheath, S.E.</i>
		1894*	Grainger, Wilfred H., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>

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Date of becoming a Student.		Date of becoming a Student.	
1895	Grant, Kenneth Stuart, <i>Alliance Assurance Company,</i> <i>1 Bartholomew-lane, E.C.</i>	1897*	Harriss, Walter James, <i>Life Association of Scotland,</i> <i>5 Lombard-street, E.C.</i>
1899*	Gray, Robert Alexander, <i>Northern Life Assurance Co.,</i> <i>London, Ontario, Canada.</i>	1896	Haskins, George Frederick, A.C.A., <i>7 Elmfield-road, Balham, S.W.</i>
1886	Greening, Herbert Joseph, <i>Abstainers &amp; General Insur. Co.,</i> <i>City-buildings, Birmingham.</i>	1894*	Hatten, David Leslie, <i>Standard Life Assurance Co.,</i> <i>3 George-street, Edinburgh.</i>
1887	Griffin, William, <i>18 Patrick-street, Cork.</i>	1891*	Haward, Thomas Gilbert, A.C.A., <i>133 Finsbury-pavement, E.C.</i>
1899*	Grigg, Benjamin, <i>Sun Life Assur. Co. of Canada,</i> <i>Montreal, Canada.</i>	1897*	Hay, John Dalziel, <i>Government Survey Department,</i> <i>Wellington, New Zealand.</i>
1899*	Guest, Smith Austin, <i>Bernina, Llanfairfechan, North</i> <i>Wales.</i>	1892	Hellyer, Arthur Lee, <i>Shannon-court, Bristol.</i>
1896*	Hallman, M. S., <i>Ontario Mutual Life Assurance</i> <i>Company, Waterloo, Ontario.</i>	1898	Henry, Norman Augustine, <i>Lancashire Insurance Company,</i> <i>18 Exchange-street, Manchester.</i>
1899*	Halloran, George Henry, <i>Australian Mutual Provident</i> <i>Society, Sydney, Australia.</i>	1897*	Hepburn, Charles James, <i>1 Elgin-road, Croydon.</i>
1892	Hancock, Arthur Tom, <i>Clerical, Medical &amp; General Life</i> <i>Assur. Soc., 15 St. James's-sq., S.W.</i>	1894*	Heslop, Anthony T., <i>1 Cedar-street, Southport.</i>
1895*	Harding, Harry Burnard, <i>Hand-in-Hand Insurance Soc.,</i> <i>26 New Bridge-street, E.C.</i>	1898	Heyner, Herbert Augustus Otto, <i>Union Assurance Society, 81</i> <i>Cornhill, E.C.</i>
1895*	Harding-Newman, Thomas Harold, <i>Scottish Amicable Life Assur.</i> <i>Soc., 1 Threadneedle-street, E.C.</i>	1889*	Hicks, Arthur Joseph, <i>Reversionary &amp; General Securities</i> <i>Company, Ltd., Northumberland-</i> <i>avenue, W.C.</i>
1895*	Harper, Sidney, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>	1896*	Hicks, Maxwell, <i>Abingdon-house, Bromley, Kent.</i>
1894	Harpour, Percy Christopher, <i>Royal Exchange Assurance Cor-</i> <i>poration, Royal Exchange, E.C.</i>	1891	Higinbotham, Harry Newburgh, <i>Royal Exchange Assur. Corpora-</i> <i>tion, Royal Exchange, E.C.</i>
1889*	Harris, Henry, <i>Friends' Provident Institution,</i> <i>Bradford.</i>	1896*	Hines, Walter Robert, <i>Norwich Union Life Office,</i> <i>Norwich.</i>
1898	Harrison, Frank, <i>56 Grafton-street, Preston.</i>	1897	Hitchins, William Richmond, B.A., <i>Manufacturers' Life Insurance</i> <i>Company, Toronto.</i>
1896*	Harrison, Tom Marriott, <i>Life Association of Scotland,</i> <i>5 Lombard-street, E.C.</i>	1896*	Hogg, Charles, <i>10 Whitehall-place, S.W.</i>
		1898	Holden, Albert, <i>9 Avondale-place, Halifax.</i>

## STUDENTS.

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Date of becoming a Student.		Date of becoming a Student.	
1894	Holdsworth, David Arundell, <i>Star Life Assur. Soc., 22 Eldon-square, Newcastle-on-Tyne.</i>	1895	Jenkyn, John, <i>Hearts of Oak Benefit Society, 17 Charlotte-st., Fitzroy-sq., W.</i>
1898*	Hooper, George Duncan, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1897	Jennings, Alfred Wilson, <i>The Crossways, Shrewsbury-rd., Harlesden, N.W.</i>
1894*	Hopping, Donald McKay, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1896*	Jepps, John Blacklee, <i>English and Scottish Law Life Assurance Assoc., 12 Waterloo-place, S.W.</i>
1895**	Horn, Ernest Frederick, <i>The Boltons, Sidcup.</i>	1898	Johnston, Arthur Edward, <i>3 Cumnor-road, Sutton.</i>
1890	Howes, John Bennett, <i>Law Union and Crown Fire and Life Insurance Company, 126 Chancery-lane, W.C.</i>	1898	Johnston, James O., <i>Law Union &amp; Crown Insur. Co., 126 Chancery-lane, W.C.</i>
1889*	Hudson, Frederick Charles, <i>Lancashire Insurance Company, Manchester.</i>	1895	Jones, Harry Stewart, <i>19 Albert-road, Brockley, S.E.</i>
1898	Hughes, Arthur J., <i>The Insurance Agency Corporation, Toronto, Canada.</i>	1899*	Jones, Leonard Alexander Mouat, <i>Hand-in-Hand Insur. Society, 26 New Bridge-street, E.C.</i>
1897*	Humphrey, Bernard, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1896*	Jones, Richard Foxley, <i>Refuge Assurance Co., Oxford-street, Manchester.</i>
1899*	Hunker, Robertson G., <i>New York Life Insur. Co., 346 &amp; 348 Broadway, New York.</i>	1896*	Jones, Wallace Mouat, <i>General Reversionary &amp; Investment Co., Ltd., 26 Pall Mall, S.W.</i>
1891	Hunt, Arthur Leonard, <i>Wesleyan and General Assur. Society, 18 New Bridge-st., E.C.</i>	1894*	Jupp, Henry Lewis, <i>Guardian Assurance Company, 11 Lombard-street, E.C.</i>
1895*	Hurst, Henry Alexander, <i>485 Bury New-road, Kersal, Manchester.</i>	1893*	Kelham, Cyril Stephen, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1893	Hutchins, Alexander Coustantine, <i>11 Pancras-lane, Queen-st., E.C.</i>	1896**	Kennington, Charles William, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1899*	Jackaman, Arthur Fredk. Samuel, <i>39 Brunswick-bldgs., Goulston-street, Aldgate, E.</i>	1898	Kidson, Leonard Douglas, <i>15 Roe-lane, Southport.</i>
1888*	Jackson, Edward Ellis, <i>Equity &amp; Law Life Assur. Soc., 18 Lincoln's-inn-fields, W.C.</i>	1896*	Kimber, Richard John, <i>Royal Insurance Co., Buenos Ayres.</i>
1890**	Jackson, Samuel, <i>Scottish Widows' Fund Life Assurance Society, Liverpool.</i>	1894**	Kingsbury, James William, <i>Australian Mutual Provident Society, Sydney, Australia.</i>
1898	Jackson, William, <i>c/o Messrs. Barclay &amp; Co., Aylsham.</i>	1899*	Kissan, Edgar Duguid, <i>Atlas Assurance Company, 92 Cheapside, E.C.</i>

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Date of becoming a Student.		Date of becoming a Student.	
1895*	Knight, Alfred Murray, <i>Bank-ho., Chapel-st., Devonport.</i>	1895** <sup>b</sup>	Macnaghten, Stenart Edey, <i>46 Brunswick-road, Brighton.</i>
1897	Krause, Holger Erasme, <i>Prudential Insurance Company of America, Newark, N.J.</i>	1896	Marlow, Thomas Gibbens, A.I.S., <i>13 St. Ronan's-road, Abbeydale Sheffield.</i>
1895	Laing, Oswald George, <i>North British and Mercantile Insurance Co., Park-row, Leeds.</i>	1896*	Marshall, Gerald, <i>Imperial Life Office, 22 Pall-mall, S.W.</i>
1890*	Lawson, Henry Graham Steuart, <i>Scottish Accident Insur. Co., Ltd., 115 George-street, Edinburgh.</i>	1893*	Martin, William Anderson, M.A., <i>Scottish Provident Institution, Dublin.</i>
1891	Layzell, Phillip Cuddington, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1894*	Maunder, George Harvard, <i>Imperial Life Insurance Co., 1 Old Broad-street, E.C.</i>
1893	Le Maistre, Charles H., <i>Penn Mutual Life Insurance Co., Philadelphia.</i>	1895*	Mayhew, Percy Craske, <i>Westminster and General Life Assurance Assoc., 28 King-st., Covent-garden, W.C.</i>
1892	Le Maistre, George Harry, <i>Assistant Accountant-General, Public Works Department, Supreme Government, India.</i>	1894*	McArthur, Harry de C., <i>Economic Life Assur. Society, 6 New Bridge-street, E.C.</i>
1894	Leonard, Maurice, <i>14 Sotheby-rd., Highbury, N.</i>	1891	McCleery, James Carlisle, F.S.S., <i>Star Life Assur. Soc., Old Bank-chambers, 8 Park-row, Leeds.</i>
1896*	Ley, James, <i>Office of the Actuary for Friendly Societies, Melbourne, Australia.</i>	1888*	McConway, James Robert, <i>Royal Insurance Co., Liverpool.</i>
1889*	Lighton, Harold John, <i>Law Union &amp; Crown Fire &amp; Life Insur. Co., 126 Chancery-lane, W.C.</i>	1895	McLeod, James Stirling, <i>c/o Messrs. Williams &amp; Keble, Ltd., Napier, New Zealand.</i>
1895*	Littell, Lewis Lloyd, <i>Standard Life Assurance Co., 83 King William-street, E.C.</i>	1897*	McPhail, Frederick Charles, <i>Colonial Mutual Life Assurance Soc., Ltd., Melbourne, Australia.</i>
1890	Love, Robert, <i>Pelican Life Insurance Company, 70 Lombard-street, E.C.</i>	1890*	Meikle, Henry George Watson, <i>F.F.A., Oriental Life Assurance Co., Bombay.</i>
1894	Lucey, Frederick Samuel, F.C.A., <i>15 George-st., Mansion-house, E.C.</i>	1897*	Melville, Charles Edward, <i>Citizens' Life Assurance Co., Sydney, Australia.</i>
1891	Lyon, Thomas Glover, M.D., <i>1 Victoria-square, S.W.</i>	1892*	Meyers, Henry Wilson, <i>National Mutual Life Association of Australasia, Melbourne, Australia.</i>
1899	Mackenzie, Michael Alexander <i>Trinity College, Toronto, Canada.</i>	1896	Milligan, Charles Livingstone, <i>Provident Life Office, 3 Cook-street, Liverpool.</i>
1898	Mackenzie, William Alexander, <i>North American Life Assur. Co., 112-118 King-st.-west, Toronto, Canada.</i>		



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Date of becoming a Student.		Date of becoming a Student.	
1894*	Mills, Thomas Percy, <i>Mutual Life Association of Australasia, Sydney, Australia.</i>	1895*	Newnham, Ernest Whiffiu, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1899*	Minns, Ernest Edwin, <i>Norwich Union Life Office, Norwich.</i>	1897	Nicholls, Robert James, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>
1897	Mirams, Arthur Greyford, <i>Australian Temperance &amp; General Life Assurance Soc., Melbourne, Australia.</i>	1895**	Norton, William Ernest, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>
1897	Moore, Arthur James, <i>Citizens' Life Assurance Co., Melbourne, Australia.</i>	1895*	Oakley, Henry John Percy, <i>North British and Mercantile Insurance Company, 61 Threadneedle-street, E.C.</i>
1898*	Moore, George Cecil, <i>Imperial Life Insurance Co. of Canada, Toronto, Canada.</i>	1891	O'Neill, Harry Duncan, <i>Clerical, Medical &amp; General Life Assur. Soc., 36 Park-row, Leeds.</i>
1895*	Moore, Gerald Leslie, A.C.A., <i>58 Coleman-street, E.C.</i>	1892*	O'Reilly, Anthony James, <i>Government Insurance Department, Ottawa, Canada.</i>
1898*	Moore, Stanley, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1897*	Osborn, Nathaniel Banner Francis, <i>34 Lansdowne-road, Tottenham, N.</i>
1895*	Morgan, George Frederick Hughes, <i>Law Guarantee &amp; Trust Society, 49 Chancery-lane, W.C.</i>	1893*	Owen, Edgar Theodore, F.S.S., <i>Registrar of Friendly Societies, Perth, Western Australia.</i>
1893*	Morland, Alfred, <i>Morland-road, Croydon.</i>	1893*	Papps, Percy Charles Herbert, <i>Canada Life Assurance Company, Hamilton, Toronto.</i>
1894	Morley, Alfred Lampen, <i>9 Montague-road, Wimbledon.</i>	1891*	Parisot, Oscar, <i>Institute of Actuaries, Staple-inn-hall, Holborn, W.C.</i>
1896	Morrison, Hubert Peter, <i>2 Edmund-street, Birmingham.</i>	1895*	Pascoe, William Yeoman Bennett, <i>Prudential Assurance Company, Holborn-bars, W.C.</i>
1897*	Mower, George S., M.Sc., <i>Prudential Insurance Company of America, Newark, N.J.</i>	1897	Paton, Harry Arthur, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>
1897	Mugford, Stanley, <i>New York Life Insurance Co., Trafalgar-square, W.C.</i>	1897*	Patrick, James, <i>95 Carisbrooke-road, Liverpool.</i>
1892*	Nash, Alfred Charles, <i>Clerical, Medical and General Life Assurance Society, 15 St. James's-square, S.W.</i>	1892*	Paull, Richard Alfred, <i>225 Dandenong-road, East St. Kilda, Victoria, Australia.</i>
1896*	Neale, Maurice Baldwin, <i>Alliance Assurance Company, 61 New-street, Birmingham.</i>	1892*	Pearce, Charles Edward, <i>3 Birchwood-villas, Clarence-road, Sidcup, Kent.</i>



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Date of becoming a Student.		Date of becoming a Student.	
1898	Peirson, Percy F., 17 Hertford-street, Coventry.	1898	Read, William A., <i>Prudential Assurance Company</i> , Holborn-bars, E.C.
1896*	Penman, William, <i>Northern Assurance Company</i> , 1 Moorgate-street, E.C.	1898	Reynell, Guy Courtenay, <i>Etherton Lodge</i> , East Sheen, S.W.
1897	Pennington, Cyril Burn, 23 Trebovir-rd., Earl's-court, S.W.	1898	Rhodes, Francis, <i>Lancashire Insurance Co.</i> , 18 Exchange-street, Manchester.
1896**	Penny, Charles Augustus, <i>Prudential Assurance Company</i> , Holborn-bars, E.C.	1894*	Richards, Gilbert P. A., <i>Royston-villa</i> , New Barnet.
1895*	Peters, Charles Furness, <i>L'pool. Victoria Legal Friendly Society</i> , 18 St. Andrew's-street, E.C.	1897*	Richmond, George William, <i>Scottish Widows' Fund Life Assur. Society</i> , 28 Cornhill, E.C.
1898*	Pigrome, George Davey, <i>Prudential Assurance Company</i> , Holborn-bars, E.C.	1894**	Rietschel, Hermann Julius, <i>Sun Life Assurance Society</i> , 63 Threadneedle-street, E.C.
1898	Poort, Willem Anthonie, Phil. Nat. Doct., <i>Middelberg</i> , Holland.	1898	Robertson, Douglas Gordon, <i>Essex-lodge</i> , Muswell-hill, N.
1897	Povah, John Frank, <i>Nelson</i> , British Columbia.	1896*	Robinson, Frederick Charles, <i>Royal Exchange Assur. Corpora- tion</i> , <i>Royal Exchange</i> , E.C.
1892*	Powell, Harold Charlesworth, <i>Equitable Life Assurance Soc.</i> , <i>Mansion-house-street</i> , E.C.	1898*	Robinson, Hugh Thomas Kay, <i>Clergy Mutual Assurance Society</i> , 2 & 3 Sanctuary, Westminster, S.W.
1893*	Pownall, Herbert Wilfred, <i>Australian Mutual Provident Society</i> , Adelaide, Australia.	1897	Rogers, Vivian Fydel, <i>Scottish Amicable Life Assur. Society</i> , 1 Threadneedle-st., E.C.
1898*	Pring, Arnold Lyddon, <i>Prudential Assurance Company</i> , Holborn-bars, E.C.	1893*	Roll, Frederick James, <i>Pearl Life Assurance Company</i> , <i>London-bridge</i> , E.C.
1897	Proctor, Jr., William, <i>Refuge Assurance Company</i> , <i>Oxford-street</i> , Manchester.	1893*	Roodenburch, Bartholomeus Adrianus, <i>Algemeene Maatschappij van Levensverzekering en Lijfrente</i> , <i>Damrak</i> , 74, Amsterdam.
1895	Quare, Lionel Brain, <i>Equity &amp; Law Life Assur. Soc.</i> , 18 Lincoln's-inn-fields, W.C.	1895*	Ross, Christopher Watson, <i>Radam's Microbe Killer Medicine Company</i> , <i>Elizabeth-street</i> , Melbourne, Australia.
1886*	Quick, John Richard, <i>Equity &amp; Law Life Assur. Soc.</i> , 18 Lincoln's-inn-fields, W.C.	1895	Rowley, James Edward, 7 Waterloo-street, Birmingham.
1897*	Ramwell, James Murray, <i>Lancashire Insurance Company</i> , 18 Exchange-street, Manchester.	1895*	Rudd, Alfred James, <i>Australian Widows' Fund Life Assurance Society</i> , Melbourne, Australia.

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Date of becoming a Student.		Date of becoming a Student.	
1899*	Rutter, Edward Valentine, 129 Tredegar-road, Bow, E.	1895	Simmons, Lancelot, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>
1894	Salter, George Ferry, Mem. Act. Soc. Amer., <i>Prudential Life Insurance Co.</i> <i>of America, Newark, N.J.</i>	1892*	Simpson, William Murray, <i>North British and Mercantile</i> <i>Insurance Company, 61 Thread-</i> <i>needle-street, E.C.</i>
1894*	Sanderson, Finlay, <i>North British and Mercantile</i> <i>Insurance Company, 61 Thread-</i> <i>needle-street, E.C.</i>	1891*	Sindall, Alfred John, <i>London and Lancashire Life</i> <i>Assurance Co., 66 Cornhill, E.C.</i>
1894*	Saunders, Herbert Stewart, M.A., 3 Bolton-gardens, S.W.	1888**	Slinnon, William James, F.F.A., 23 Grosvenor-street, Edinburgh.
1892*	Savery, Robert S. B., <i>Gresham Life Assurance Society,</i> <i>Giselastrasse, No. 1, Vienna.</i>	1899*	Skelton, Reginald Albert, <i>c/o Messrs. H. J. Skelton &amp; Co.,</i> <i>12 Lime-street, E.C.</i>
1897	Sawtell, John A., <i>Law Accident Insurance Society,</i> <i>215 Strand, W.C.</i>	1895*	Smeaton, John Richard, <i>Alliance Assurance Company,</i> <i>Birmingham.</i>
1897*	Scott, Alexander Lewis, <i>Australian Mutual Provident</i> <i>Society, Melbourne.</i>	1897*	Smibert, Charles Ritchie, <i>Trustees, Executors and Agency</i> <i>Company, Limited, 412 Collins-</i> <i>street, Melbourne, Australia.</i>
1891*	Searls, Edwin Richard, <i>Northern Assurance Company,</i> <i>1 Moorgate-street, E.C.</i>	1894*	Smith, Lionel Gordon, <i>Wycroft, Bexley.</i>
1888	Sewell, Richard, C.A., F.F.A., 63 Threadneedle-street, E.C.	1897	Soper, Frederick Walter, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>
1891**	Sharman, William Charles, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>	1897*	Stamp, Horatio E., <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>
1886*	Sharp, Joseph Benjamin, <i>Clerical, Medical and General</i> <i>Life Assurance Society, 15 St.</i> <i>James's-square, S.W.</i>	1898**	Stewart, Lionel William, <i>Alliance Assurance Company,</i> <i>Bartholomew-lane, E.C.</i>
1892*	Sharpe, Edgar Cecil Engledue, <i>London Life Association, Ltd.,</i> <i>81 King William-street, E.C.</i>	1886**	Stirling, James, <i>Scottish Imperial Insurance Co.,</i> <i>183 West George-st., Glasgow.</i>
1896	Shawyer, John William, <i>Law Union &amp; Crown Fire &amp; Life</i> <i>Insurance Co., 126 Chancery-</i> <i>lane, W.C.</i>	1888*	Stott, Walter, <i>Royal Insurance Co., Liverpool.</i>
1896*	Shute, Oxenham Bent, <i>National Provincial Bank of</i> <i>England, 53 Baker-street, W.</i>	1893*	Streeter, Theodore Edward, 22, Ashmead-road, St. John's, S.E.
		1899*	Stuckey, Reginald Robert, <i>Australian Mutual Provident</i> <i>Society, Adelaide, S. Australia.</i>

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Date of becoming a Student.		Date of becoming a Student.	
1895*	Sutton, Cecil Norman Stafford, <i>Marine &amp; General Mutual Life Assurance Society, 14 Leaden-hall-street, E.C.</i>	1891	Waters, Charles Preston, <i>Equitable Life Assur. Society, Mansion-house-street, E.C.</i>
1892*	Tappenden, Laurence Barnard, <i>Strathmore, 15 Burlington-gdns., Chiswick, W.</i>	1894	Watson, Norwood Alexander Reid, <i>71 Queen Elizabeth's-walk, Stoke Newington. N.</i>
1889*	Taylor, John Theodore, <i>Templemore-park, Londonderry.</i>	1896	Way, Claude Frederic, <i>Scottish Widows' Fund Life Assurance Society, 28 Cornhill, E.C.</i>
1895	Taylor, Leopold Victor, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1899*	Weatherill, Charles, <i>The Scottish Office, Whitehall, S.W.</i>
1895*	Thistlethwaite, William, <i>4 Warren-terrace, Wakefield.</i>	1898*	Webb, Lloyd, <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>
1897*	Thorne, Charles McKellar, <i>Temperance &amp; General Life Assur. Co., cr. Swanston &amp; Little, Collins-st., Melbourne, Australia.</i>	1893*	Welman, Arthur Joseph, <i>Legal &amp; General Life Assurance Society, 10 Fleet-street, E.C.</i>
1897*	Tipping, Oswald, <i>Trustees, Executors and Agency Co., Ltd., 412 Collins-street, Melbourne, Australia.</i>	1888	Westland, James Black, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1897*	Touzel, Philip Duncan, <i>Australian Mutual Provident Society, Melbourne, Australia.</i>	1896*	Wheatley, George Frederick Layfield, <i>Liverpool and London and Globe Insurance Company, 7 Cornhill, E.C.</i>
1897*	Townshend, Edward Villiers, <i>North British and Mercantile Insur. Co., 61 Threadneedle-st., E.C.</i>	1897*	Wigner, John Gurney, <i>92 Tyrwhitt-road, St. John's, S.E.</i>
1897	Truzzell, Harry, <i>Northern Assurance Company, 15 Victoria-street, Nottingham.</i>	1886*	Williams, David, <i>181 Queen Victoria-street, E.C.</i>
1891	Tyler, Edgar Alfred, F.S.S., <i>1 Queen Victoria-street, E.C.</i>	1894*	Williams, Frederick Alfred, <i>34 Sotheby-road, Highbury, N.</i>
1893	Vine, George Henry Mesban, <i>23 Grange-road, Canonbury, N.</i>	1895*	Williams, Henry Samnel Walter, <i>The Imperial Insur. Co., Ltd., 410 Collins-street, Melbourne, Australia.</i>
1895*	Walker, David Edgar, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1899*	Williams, William, <i>Underwood, Margaret-street, Strathfield, N. S. W., Australia.</i>
1896	Walter, Frederic Percy, A.C.A., <i>11 Ironmonger-lane, E.C.</i>	1890*	Wilson, George, <i>Standard Life Assurance Company, Edinburgh.</i>
1898	Ward, Albert E., <i>Australian Mutual Provident Society, Melbourne, Australia.</i>		

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Date of becoming a Student.		Date of becoming a Student.	
1896*	Wilson, John Sydney, <i>Australian Widows' Fund Life Assurance Society, Melbourne, Australia.</i>	1888**a	Worthington, William, <i>Lancashire Insurance Company, Exchange - street, St. Ann's-square, Manchester.</i>
1894*	Windett, Sydney V., <i>Eagle Insurance Company, 79 Pall-mall, s.w.</i>	1894*	Wyatt, George Matthew, <i>Law Guarantee &amp; Trust Society, 49 Chancery-lane, W.C.</i>
1888*	Wingfield, Harry, M.A., A.C.A., <i>64 Cannon-street, E.C.</i>	1894*	Wylie, Samuel Brown, A.M., <i>112 N. Broad-st., Philadelphia.</i>
1899*	Winstanley, Charles William, <i>North British &amp; Mercantile Insur. Co., 8 Waterloo-place, s.w.</i>	1886	Yeatman, Alexander Alfred, <i>2 Gresham-buildings, E.C.</i>
1895*	Wood, David James, <i>Commercial Union Assurance Co., 24, 25 &amp; 26 Cornhill, E.C.</i>	1895*	Yeldham, William James, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1896	Woodhouse, Hubert Allen, <i>Union Assurance Society, 81 Cornhill, E.C.</i>	1894*	Young, Arthur Stanley, <i>Commercial Union Assurance Co., 24, 25 &amp; 26 Cornhill, E.C.</i>
		1897*	Younger, R. Hugh, <i>Lancashire Insurance Co., 18 Exchange-street, Manchester.</i>

\* \* \* It is requested that any inaccuracy in the foregoing list may be pointed out to the ASSISTANT SECRETARY.

## CORRESPONDING MEMBERS.

## Belgium.

## BRUSSELS.

M. Henri F. G. Adan,  
*Directeur Général de la Royale Belge  
Compagnie Anonyme d'Assurances à  
Forfait sur la Vie, et contre les  
accidents, Rue Royale (coin impasse  
du Parc), Membre de la Commission  
Centrale de Statistique du Royaume  
de Belgique.*

M. AM. Bégault, Mem. Act. Soc. Amer.,  
*Actuary, Compagnie belge d'Assur-  
ances générales sur la vie. Membre  
de l'Association des Actuaires Belges.  
Membre correspondant de l'Institut  
des Actuaires Français.*

M. Léon Duboisdeghien,  
*Directeur à la Caisse Générale  
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## RULES

FOR THE

## REGULATION OF THE LIBRARY.

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2. Members of the Institute are permitted to take out Two Books on making application in person, or by letter addressed to the *Assistant Secretary*; but no Member may keep any work longer than a FORTNIGHT. When a Book is returned by a Member, it can be borrowed by him again, provided it has not been bespoken in the meantime by another Member.

3. Scientific Journals and Periodicals are not circulated until the volumes are completed and bound.

4. Cyclopædias and works of reference are not circulated.

5. Any Member damaging a work must pay a fine equivalent to the injury.

6. Works taken from the shelves for reference are not to be replaced, but must be laid on the Library table.

7. The Honorary Secretaries shall report to the Council any infringement of these Regulations.



# JOURNAL

OF THE

## INSTITUTE OF ACTUARIES.

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*Opening Address by the President, H. W. MANLY, Esq.*

[Delivered 27 November 1899.]

I HAVE been urged to open my second year of office with another Address, and in complying with the request, I feel that I am following a bad precedent, for I am afraid that the practice will become the rule instead of the exception, and my successors will be inclined to blame me for not resisting the blandishments of the Council more firmly. I have been given to understand that several of the Members have valuable and important papers on the stocks, which are not yet ready to be launched on the sea of criticism, and it is for this reason that I have consented to occupy your attention to-night. I should like to express a fervent hope that the authors will not take too long in putting the finishing touches on their work, but let the Honorary Secretaries have the papers early in the session.

Talking about "finishing touches", I may tell you, in confidence, that my experience is that they are much better put on when you see the whole thing in print. If you write simply and naturally, you will find that very little touching-up is necessary, while if you try to write something extremely brilliant, or, as an artist would say, "paint up your picture" too much, you will either spoil the effect, or find that you must write most

of it over again. I seldom write an exceedingly florid and brilliant paragraph, but what my pen is struck through it on calm reflection. To me, it never looks so sublime in print.

As I have, almost unconsciously, started on the road of literary composition, I will ask you to stroll with me a little further along the path. Our scientific work is full of refinements and subtleties, and instead of growing less, they are actually increasing. The improvement in the construction and form of our Mortality Tables, and the development of the application of the Integral and Differential Calculus, have necessitated the employment of new terms, which, if they do not convey exact meanings, will lead to endless confusion. I would urge you, therefore, to cultivate, at all times, accuracy of expression. Many of our expressions are quite misleading, and although *we* know what they mean, the public, when they get hold of them, attach quite different meanings to them, and then fancy they know all about it. Take, for example, the expression "The Expectation of Life." This term has become so rooted in our language that even the Joint Committee now sitting on the New Experience did not feel equal to discarding it. It is intended to express the average number of years which all persons of a stated age will live according to a certain Mortality Table, and is seldom used by us except for the purpose of comparing the general effect of different mortality tables. But the popular idea is that it is an actuarial estimate of the number of years a single life will live; and the natural deduction is that of course all our calculations are based on that particular function. The idea is still further fostered by the fact that "A Table of the Expectation of Life" is the first Table which appears in those cheap works which have for their object to make "Every man his own Actuary." What a common thing it is to hear the question "What is my expectation"? and when you reply "You don't know, you only wish you did", what an expression of surprise comes over the inquirer's face. He thinks you are only feigning ignorance, and frequently proceeds to explain that he only wants to know how many years you reckon he is going to live when you calculate his premium; and when you tell him that the premiums are not calculated that way, I believe he very often thinks you are a fool and don't know your own business. The proper reply would be, "I do not know how long you are going to live, but if there were a thousand of you I could tell very nearly how long on the average you would all

“live. That average life-time, however, has nothing whatever to do with the calculation of the premiums. When we insure your life we cease to look upon you as an unit, and you become to us one of a large class like yourself. Now we know, within reasonable limits, how many claims out of that class we shall have to pay the first year, the second year, and so on, until all are dead, and we have to find the average contribution (after allowing for accumulations of interest) which you all have to make to enable us to pay those claims as they arise. That contribution is the premium which you have to pay.” As a rule, that generally disposes of the fallacy that all our calculations are based upon “The Expectation of Life.”

There is one word in the English language which is so frequently used in a sense diametrically opposed to its true meaning, that there is a fear that the false meaning will permanently displace the correct one. I refer to the word “Insurer.” Now, according to the principles of the construction of the English language, the insurer is the one who insures, that is, in Life and Fire Insurance, the Company. The definition given in the *Century Dictionary* is, “One who contracts, in consideration of a stipulated payment called a *premium*, to indemnify a person or company against certain perils or losses, or against a particular event; an underwriter.” Yet this word is now commonly used to express, not the one who indemnifies, but the one who is indemnified. I am bound to say that members of our profession are not entirely above suspicion; but the great criminals are the Fire Insurance Companies, the Agents, and newspaper writers. I saw recently an advertisement of a Fire Insurance Company in a magazine, where the following line was displayed in prominent type:—“Large and important benefits to Insurers.” That was supposed to be an attraction to persons wishing to be insured, but those who knew the true meaning of the word would, I should think, carefully avoid that company. I once saw a very large illuminated show-card with this heading very prominently displayed—“Capital, One Million. Paid-up Capital, £50,000. INSURERS INCUR NO LIABILITY.” Oh, happy shareholders! This misuse of the word arises, I have no doubt, from the careless way in which the verb, to insure, is used, particularly in that class of literature which is written by Agents for Agents, or for the public. “Insure! Insure! Insure!” “Have you insured your life?” “Insure before it is too late.”



“Three months before John Jones died he insured his life.” “I send you a form to insure your life”; and we talk freely of the necessity of a man insuring his life. Now, if a person insures his own life he naturally becomes the insurer. But, if you will only stop to consider what it means, you will see that it would be a ridiculous proceeding, for he would have to pay the premium to himself, and guarantee the payment of the sum assured on his own death. Our forefathers were much more careful in their use of the English language. It was always “The Society undertakes to insure the lives, property, &c.” The proposal form was, “A proposal to make an assurance on the life of”, or, “A proposal to effect an assurance with.” They would have said, “Be insured.” “Have you effected an assurance upon your life?” “John Jones effected an assurance on his life three months before he died.” “It is the bounden duty of a person to be insured.” Perhaps I am a Mrs. Partington trying to sweep back the tide of corruption with a broom; but I may at least appeal to you to use these words correctly in your writings, and so help to keep the English language pure.

There is another expression which is used indifferently, and that is “years in force.” I think it is very important that expressions like this should have exact and definite meanings attached to them, for there are subtle variations of this expression coming into use in connection with the new Experience Tables, which I have already hinted at, and which I shall refer to directly, and of which we shall have to be very particular. Now, when has a policy been one year in force? If we are referring to the surrender-value of a policy, we define it as “when the second annual premium is due but not paid.” That appears to be a clear and exact definition. But in the allotment of bonuses, “years in force” is generally made synonymous with “number of premiums paid.” In that very valuable and useful work, Monilaw’s “Surplus Funds”, the author used to give a short summary, prepared by each company, of the “Principles regulating the Distribution of Surplus”; and out of 48 well-known companies, distributing their profits by way of reversionary additions, I find 28 distinctly stated that the basis was the number or amounts of premiums paid. One company gave an alternative definition—“for each year which has elapsed or full annual premium which has been paid.” That seems an unnecessary and unfortunate definition, for a year cannot have *elapsed* immediately on the

payment of the first full premium, any more than the policy could have been in force one year. Twelve other companies which also, I believe, allot their bonuses according to the number of premiums paid, were very indistinct in their explanations, generally describing their methods of distribution to be according to the number of years in force. Out of the remaining eight companies, three clearly defined a year in force to be a complete year, or an entire year, or when the next premium is due, and they are classified in the work as giving no bonus in respect of the first year. Two companies, whose descriptions were very vague, and might as easily have been construed as giving a bonus in respect of every premium paid, are, in the body of the work, classified as giving no bonus for the first year. The remaining three are classified as giving bonus for each premium paid, but it seems doubtful whether they should come under that category. One said, "Policies issued since the last valuation receive profits proportioned to their *time* in force"; another said, according to "the number of *entire* years comprised in their respective periods of duration"; and the third said, "In cases of policies which shall not have previously received additions, on the original amount assured, and that for the number of years such policies shall have *existed*, previous to the investigation." Mr. Monilaws has, I presume, intentionally followed the wording in the Fifth Schedule of the Life Assurance Companies Act 1870, in his heading "Number of years in force"; but Acts of Parliament are not always models of pure English, or of exact definitions, and it would be much more correct if he were to substitute "number of annual premiums paid" for "number of years in force." I know that some hypercritical person might say that people do sometimes pay up a number of premiums in advance; but there are very few of them, and an explanation might be given, if thought necessary, that the heading means the number of annual premiums due and paid.

In preparing the volume of "Unadjusted Data" of the new Combined Experience of Life Annuitants (1863-1893), the Joint Committee of the Faculty of Actuaries and Institute of Actuaries have been very careful to use descriptions which ought not to be misunderstood. It will have to be borne in mind that in the tabulation of the data the nearest integral age at entry was assumed to be, on the average, the exact age at entry, and the contract year was adopted as the year of exposure to observation.

The years of duration of the contract are exact and complete years dating from the day of purchase; but instead of reckoning time by periods such as the year of duration or of observation, the very convenient plan used by Dr. Sprague in his Select Tables has been adopted, of reckoning by intervals of complete years elapsed since the date of purchase. Besides being definite in expression, this has the special advantage of preserving the uniformity of our notation, and making the new symbols self-explanatory. Thus we have for the probability of living one year at the date of purchase,  $p_{[x]}$ ; for the probability of living for one year commencing one year after the date of purchase,  $p_{[x]+1}$ ; and so on. The probability of dying in the year of purchase is  $q_{[x]}$ , and of dying in the year commencing one year after the date of purchase is  $q_{[x]+1}$ , and so on. The value of an annuity at purchase is  $a_{[x]}$ , and at exactly one year after purchase  $a_{[x]+1}$ , and so on. These descriptions, however, are too long for general use, and, moreover, we want some expression to denote the contract year. We cannot very well describe the first year of the contract as the year 0 elapsed since purchase, and so we have agreed to call the first year of the contract the first year *following* purchase, the second year of the contract the second year *following* purchase, and so on;  $q_{[x]+1}$  consequently represents the probability of dying in the second year following purchase, or in the year commencing one year after the date of purchase. It will be necessary to draw a marked distinction between *following* and *after*; for we shall speak of the value of an annuity at purchase, at one year after purchase, at two years after purchase; but an annuity for the first year following purchase would be a term annuity for one year at purchase. These may appear at first to be subtle distinctions; but once learnt they can never be mistaken. If, however, they are used carelessly and indifferently, endless confusion will arise.

Although I am endeavouring to impress upon you the necessity of using clear and exact expressions, I hope you will not imagine that I am priggish enough to set myself up as a pattern of a model writer. I know I am far from perfect, but that does not prevent me from attempting to reach a high ideal.

The mention of the word "model" reminds me of the curious transposition by which a hypothetically constructed table, representing the liabilities of an office, which was used as a model, was converted into "a model office." The

definition has the advantage of brevity; and as we all know what it means, there is no need to say much about it; but as I may fairly claim to be the original inventor of the Table, I should like to record that I did not give it that title.

I shall not pursue this lecturing vein further; but, as the utterances of your Presidents on these occasions partake somewhat of a public address, I think it would be instructive to my larger audience if I were to explain and unmask some of the common fallacies concerning our business.

I have already referred to the common fallacy that all our calculations are based on the "expectation of life", and shown how the fallacy has arisen and how wrong the generally formed opinion is. Our medical advisers are very fond of this Table, and talk learnedly about a man's expectation. Here, again, we find the rooted impression that we make an actuarial estimate of how long a single individual should live. I do not altogether object to their using the Table, because it gives them a standard of vitality, which is useful, but their deductions are not always sound. For instance, this is not at all an uncommon argument:—The "expectation" at 30 by the H<sup>M</sup> Table is 34.68 years. This man's expectation is 30 years; therefore he ought to be rated up six years because the "expectation" at 36 is 30.29 years. Now, the question I always want to put to the doctor is this:—What do you mean by "this man's expectation is 30 years"? Do you mean that he is going to die at 60 years of age, or that if there were a thousand like him they would, on the average, live 30 years? If the former, I want a premium that shall be at least equal to the premium for an endowment assurance payable at 60; if the latter, then, although your argument is not actuarially correct, the estimate is near enough "for all practical purposes."

But has the Medical Profession any knowledge of those conditions, or forces, or organisms, or whatever it may be, which resist the force of mortality for a long period of time? Do they know anything, in fact, of the force of vitality? I think not, or, if they do, it is very little. It is not the robust men, as a rule, that live to extreme old age, but mostly those who would generally be described as of weak physique. Their delicate physique may cause them to lead more regular and temperate lives, but there must be something beyond that, because you will find that long life is generally hereditary. It may be that some day this force



of vitality will be understood, but until then I think our medical advisers should give up talking about a man's expectation, and rely more upon statistics. The doctor must refer to the actuary for his statistics; and the actuary must accept the doctor's diagnosis. In our work the doctor and the actuary should always consult together on doubtful points. If either tries to do the other's work, he is almost sure to go wrong: together, they should produce wisdom.

It is surprising what a large number of persons there are who imagine they possess the whole knowledge of an actuary when they own an *olla podrida* collection of actuarial tables. On inquiring who are the principal purchasers of these works, I learn that they are lawyers, auctioneers, and accountants. Now, it is a common saying amongst lawyers, that those works that pretend to make "Every man his own Lawyer" have been productive of additional work for the lawyers; yet they cannot see that there is the same kind of folly in every lawyer trying to be his own actuary. There is, however, this difference: that "Every man his own Actuary" brings more work to the lawyer than it does to the actuary. Auctioneers make the most reckless use of these tables, which, I think, accounts for the astounding prices sometimes given for reversionary interests in the market by private individuals. "Every man his own Actuary" should be put in the same category as "Every man his own Lawyer" and "Every man his own Doctor." In each case, expert knowledge is required to use and apply the information.

Life Assurance is a commercial undertaking, and therefore, we are told, should be conducted on commercial principles. Yes, that is true; but, and this is a large BUT, for whose benefit is it conducted? Is it for the benefit of the shareholder, or the insured, or the manager, or the agents? The answer we should like to give would be: For all. But then these interests are largely antagonistic; and although we find them combined in a few cases, it is not, as a rule, in those companies which conduct their business on, what is generally understood to be, commercial principles. In an ordinary commercial undertaking the whole of the profits belong to the trader (or firm of traders), and therefore, if he can do three times the business at half profits, or ten times the business at quarter profits, his total profits are largely increased, although his expenditure, in certain directions, may have been increased ten or fifty-fold. That is what is generally understood by commercial enterprise; but if you apply the same



principle to Life Insurance business, it will not prove so successful. In Mutual Insurance Companies, which are purely co-operative, all the profits are returned to the members; and Proprietary Companies, in order to compete with the Mutual Societies, are obliged to divide a large proportion of the profits among the policyholders. Suppose then that one of these companies, like our enterprising trader were, by a large expenditure which would reduce the individual profits to half, to treble its business, what would be the effect? The total profits would be 50 per-cent more, but as they would have to be divided amongst three times the number of policyholders, each would get half the profits he received before. Then who has benefited? Certainly not the assured; but if it is a Proprietary Company, the shareholders taking a fixed percentage of the total profits, will receive 50 per-cent more dividend, and as the manager has been instrumental in increasing the dividend, he will be rewarded by an increase in his salary, and the agent will probably have received larger commissions. The only person, therefore, who has suffered is the policyholder. This is not always the case; but I want to show that so-called commercial principles cannot be applied to life insurance business without the addition of a very important condition; and to lay down this proposition: that a life insurance company, transacting a very large business, is not necessarily the best for the assured. The condition necessary to make the commercial principle good, is that increased business shall be accompanied by a decrease in the *rate of expenditure*. An increased expenditure to obtain increased business may be, and has been justified, as in a case where the increased expenditure is in the nature of a fixed outlay, such as rent for branch offices or a fixed amount expended in advertising, so that as the business increases while the expenditure remains stationary, the rate of expenditure decreases; and it is possible, although very difficult of accomplishment, to eventually reduce the rate of expenditure below what it was before the large outlay was determined upon. The number of offices which have done this can certainly be counted on the fingers of one hand, and not all the fingers would be required then. And why? Because the management becomes afflicted with a kind of mania, that the new year's business must beat the record of each preceding year. This struggle for more new business increases the competition and so raises the price, with the result that the high rate of expenditure seldom comes down. I have been very pleased to see that one notable and

important company, which has accomplished the difficult task of obtaining a large increasing business accompanied with a decrease in its expense ratio, has made an out-spoken protest against "the unwholesome competition which daily confronts the officials" and representatives of the Society, who, with regret, see large amounts of desirable business taken past them by persons demanding heavy commissions and rebates, which the directors have not thought it in the interest of the members to allow." It is a noble and honourable stand to take "in the interest of the members;" and I hope that the strong position thus taken up by one of the wealthiest, and most prosperous, and most honourably conducted of our companies, will be firmly adhered to; that the lead thus given will be followed by others; and that "the interests of the assured" will not be lost sight of in the violent efforts to produce large figures. It is a truism, which the public would do well to learn, that a large new business obtained at great cost is not synonymous with prosperity. They learnt it thirty years ago when the "Albert" and the "European" failed, and they may learn it again, to their sorrow, some day. It may seem a paradox, but it is nevertheless a fact, that an insurance company can exist for many years, with great benefit to its assured, without any new business at all.

It has become the fashion to excuse an extravagant rate of expenditure by an ingenious jugglery with figures, and we are occasionally treated to the interesting spectacle of seeing the most economically conducted offices placed in the position of the most extravagant. A kind of topsy-turvydom takes place which would require the genius and the wit of a W. S. Gilbert to appropriately describe.

Now let me try to put this question of expenditure in a plain matter-of-fact way. The power of the companies to pay the claims as they mature, and to declare profits, depends upon the accumulation of the premiums at compound interest; assuming, of course, that the premiums charged are adequate. Whatever is spent then out of those premiums, must diminish the amount which has to be accumulated. Suppose there are two companies, each receiving premiums amounting to £100,000, but one company spends £30,000 and the other £10,000. It is evident that the first company has only £70,000 to accumulate, while the second has £90,000; and it seems the most natural conclusion to say that the first company spends 30 per-cent of its premium

income, while the second only spends 10 per-cent. But now we are told this is quite wrong. You must take into consideration the amount of new business which each company obtains. In the first company the £100,000, we will say, is made up of £25,000 of new premiums and £75,000 of renewals; while the second company's £100,000 consists of £2,500 new premiums and £97,500 renewals. The objectors to the simple percentage plan are not, however, at all unanimous as to the proper method to be substituted. One set will say, you ought to charge the new premiums with 100 per-cent and the percentage of the balance on the renewal premiums is the true rate of expenditure. Thus, in the first company you should charge £25,000 to the new business, and the balance of £5,000 to the renewals, which only amounts to 6·7 per-cent; and in the second company, if you charge £2,500 for new business, you will find that the balance of £7,500 works out at 7·7 per-cent on the renewals. The second company is, therefore, the more extravagantly managed. Another set will say, that is not quite right, because you ought to find out how much your new business costs. You ought to charge the renewals with  $7\frac{1}{2}$  per-cent, and the balance will show the cost at which you are obtaining your new business; and if you apply that method to the example, you will find that the first company obtains its new business at a cost of  $97\frac{1}{2}$  per-cent, while the second pays  $107\frac{1}{2}$  per-cent for it, showing that the second is 10 per-cent more extravagant in the management of its business than the first. These two plans land the operator in a difficulty sometimes, for he will occasionally discover that a company is either carrying on its old business at a profit instead of an expense, or it is obtaining its new business for less than nothing. Another method which is used is, to divide the percentage of expense between the new premiums and the renewals in the ratio of 10 to 1. I could never see any possible reason in this; but the computer gets the reputation of being very clever to perform such an intricate piece of calculation, and it has the merit of escaping the absurd situation which I have just referred to in the application of the other methods. No matter how economically an office is conducted, a percentage can always be produced for both new and renewal business. Applying this last plan to our example, we would be told that the expenditure of the first company was 92·3 per-cent of the new premiums, and 9·23 per-cent of the renewals, while the second spent 81·6 per-cent of its new premiums and 8·16 per-cent on the renewals, showing

the first to be about 10 per-cent more extravagant than the second.

Now, the question I want to put to you is this:—Does all this jugglery alter the significant fact, that the first company has only £70,000 to accumulate while the second has £90,000?

You may prefer to answer me in the reputed Scotch fashion, by asking me another question. You may ask—How, then, do you account for some companies like the first occasionally giving almost as good a bonus as some like the second? Well! that does seem a little difficult to answer; but I will endeavour to do it. In the first place you will observe that the business of the first office is much younger than that of the second. Its claims have been lighter in comparison by reason of the recent selection, and it probably uses a method of valuation which enables it to bring into surplus what used to be called the profit arising from suspended mortality, but which would be better expressed as “the reserve which should be made for deferred mortality.” But that is not the main answer. There is such an operation as that called, in the language of the betting-ring, “hedging.” The first company probably does not give any surrender-value until after three or five annual premiums have been paid, and will, in all probability, give a much less surrender-value than the other at any time. Now, business obtained at a high price runs off very rapidly in the first year or two, and we know that the mortality in the first few years of assurance is very light, so that as the office gives no surrender-value for those policies which lapse in the first two, three, or four years, it can set the premiums it has received on such policies which are not renewed, less their share of the claims, against the total outlay, as well as the profit it may make by reason of the smaller surrender-values it gives on policies of longer duration, and this I think will account for much of the way in which the heavy expenditure is recouped.

I should like to illustrate this by applying the argument to my previous example. Suppose the whole of the £25,000 received in new premiums by the first company was not renewed. The mortality in the first year of assurance, we will say, is only about  $\frac{1}{2}$  per-cent of the sum assured, or  $\frac{1}{6}$ th of the premiums. £4,167 would be paid in claims, and the balance, £20,833, could legitimately be set against the expenditure of £30,000, leaving £9,167 as the cost to be debited to the £75,000 of renewals, which is only 12·2 per-cent. Next, suppose that  $\frac{2}{5}$ ths runs off in the first year and  $\frac{1}{5}$ th in the second, then the company might



fairly say, out of £10,000 which will not be renewed at the end of the first year, only £1,666 will be paid in claims, and of the £5,000 which will only last two years, the claims in the first year will only amount to £833, and of the £4,975 received in premiums the second year, only £1,658 will be required for claims (assuming the mortality in the second year to be 1 per-cent, or  $\frac{1}{3}$ rd of the premiums), so that the company will have received in premiums £19,975, out of which it will have paid claims of £4,157, leaving a profit of £15,818 to be set against the £30,000 of expenditure, and therefore only £14,182 is chargeable against the remainder of the premium income of £85,000, which is at the rate of about 16·7 per-cent. Let us, however, come nearer to actual facts, and say that 20 per-cent runs off the first year and 10 per-cent the second year. (This is about twice the average rate.) There would be only £7,908 to set against the outlay of £30,000, and consequently premiums of £92,500 would have to bear the cost of £22,092, which amounts to nearly 24 per-cent. It would appear, therefore, that with an extravagantly conducted assurance company, the longer surrender-values and other benefits are deferred, and the faster the new business runs off, the better it is for the persistent policyholder. Does not this explain, to a very large extent, the success of the American Tontine system in the past, when no surrender-values at all were given? And is it not fair to assume that the more the American companies fall into line with the British companies of giving surrender-values, and advancing loans on policies, the more their profits must diminish?

When you see a large expense ratio on the premium income, you should always look to see what means the company takes to recoup itself afterwards at the expense of the unfortunate policyholders who do not keep up their policies to the end; in fact, find out how it "hedges"; but, above all, do not be led away by any tricky manipulation of figures.

There is one other matter to which I should like to refer, if I am not keeping you too long, and that is the fallacies arising out of the announcement of claims. There is a very common sentence to be found in the Annual Reports of Companies, to the effect that the claims have been so much less than the expected. Now what does that mean, and what is it intended to convey? To my mind it means that there is a large amount of new business which has been assumed to be old, and that the proper table of



mortality has not been used. In the public mind I think the general notion is that the difference is all profit; and I am not quite sure that that is not the meaning sometimes intended to be conveyed. Now it is quite certain that those who have not died will live to die another day, and that their claims will have to be paid some time or other. You have miscalculated the number who are going to die, and the question arises whether you have made a proper reserve for those who have not died.

There is only one way, which I know of, by which you can arrive at the profit on mortality, and that is by working out what we technically call the "strain." You find out how much of your reserve fund, after allowing for interest and net premiums received in the year, has been released by your method of valuation, and compare it with the amount which has been paid away in claims. When we use select tables in their entirety, in all our calculations, we shall estimate the deaths more accurately, and the "strain" will exhibit just small variations of profit or loss.

There is one comparison which is sometimes made with claims which is quite useless, and that is a comparison of the amount paid by the company in sum assured and bonus with the premiums received accumulated at compound interest. This would be a very interesting comparison for the individual who is insured to make; but when he does make it, he generally selects some extravagant rate of interest, like 5 per-cent, and forgets that it would have been practically impossible for him to have invested such small amounts as his premium and the interest on the accumulations every year, even if he had the strong selfwill to make the periodical investments at all. Further, he altogether forgets the primary object of life assurance, which is to provide against the uncertainties of life, and also that the principle involves that those who live long must contribute for those who die early. For the company to make such a comparison for itself is meaningless. As I have already said, in a company the person insured ceases to be considered as an individual case and becomes only one of a class, and the premiums are so calculated as to provide for so many deaths in the first, second, third, &c., years. There will always be claims on which only one, two, or three, &c., premiums have been paid, and whether an individual claim has resulted in a profit or loss to the society cannot be determined by a debit and credit account of the amounts paid and received, but depends upon whether the premiums paid in

his class with the accumulations, after making the necessary reserves for the survivors, were sufficient to provide for the claims which have occurred in that class or not. Moreover, the company can never have in hand the whole of the premiums paid on all the policies in force, accumulated at compound interest. The very first claim which occurs considerably reduces the fund below the total number of premiums received; and a portion of every premium paid to the company is used to provide for the current claims. The comparison, therefore, is purely hypothetical, because it presupposes a condition which does not exist, namely, that the company has been able to accumulate all the premiums received at compound interest. If a company were to reckon its gains and losses in that way, it would appear that all the claims for the first 20 years of insurance were all losses, and yet it is in those very years that it makes the most profit from mortality.

I was once acquainted with an actuary to an office,—my contemporaries will remember him well,—who said there were only two sound actuaries in the world, himself and his brother; and who actually set out in the annual report of his company, the profit made upon lapses and surrenders during the year, by accumulating the premiums received on such policies at 3 per cent compound interest, and deducting the amounts paid for surrender. I asked him one day how he managed to pay for his claims and expenses, and whether he had a gold mine hidden somewhere? With a pitying look, he said: "You young so-called 'actuaries, bred up at the Institute, don't understand these 'matters; I will explain them to you some day.'" I never got that explanation; and as his policy became a claim many years ago, I am afraid I never shall.

I have now been talking platitudes long enough. There are still a few more fallacies which I should like to gibbet, but I must refrain. One more only shall I refer to, and that is to suppose that you can venture upon approximations with impunity. There is a good old saying, "Don't prophesy unless you know." I ask you to bear this in mind when you have any complex calculations to make. There is a kind of fascination in the desire to seek refuge in approximations; but there is a terrible danger in them "unless you know." Approximations can only be used with any degree of certainty by the expert. When you are intimate with the formulas and have worked out the extended calculations

a few times, then you may, perhaps, with some degree of safety venture upon approximations; but not before. Take, for instance, the simple problem of the probability of one at least of two lives dying in a year. It is not, by any means, the probability of one life of equivalent age, derived from your annuity table, dying in one year. Some persons are quicker at arriving at correct approximations than others; but I think you will always find that they have a much closer acquaintance with the formulas and their results than the others. It is an excellent exercise to make your approximation or guess (for it is often intelligent guesswork) first, and then work the problem out correctly afterwards. By that means, you will soon find out to what extent you can trust yourself. It will also give you that acquaintance with pitfalls which it is so essential to learn.

I thank you, gentlemen, for the patient attention with which you have listened to my remarks. They have been somewhat scrappy, but I hope I have succeeded in occasionally interesting you. You have shown me so much courtesy and consideration during my past year of office that I cannot refrain from expressing my grateful thanks for all your kindness.

It is my dearest wish to extend the power and influence of the Institute, my beloved Alma Mater, in every direction where it could be of use; and if my observations to-night, simple as they may be to you, will have the effect, in only a small measure, of educating the public, I shall feel that I have not spoken in vain.

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*"Data for the Problem of Evolution in Man. A First Study of the Inheritance of Longevity and the Selective Death-rate in Man."* By MISS MARY BEETON and KARL PEARSON, F.R.S., University College, London.

[Paper read before the Royal Society, 15 June 1899, and extracted, with permission, from the Proceedings of the Royal Society.]

1. ACCORDING to Wallace and Weismann\* the duration of life in any organism is determined by natural selection. An organism lives so long as it is advantageous, not to itself, but to its species, that it should live. But it would be impossible for natural

\* See Weismann, *On Heredity*, Essays I and II, and especially Professor Poulton's Note as to Wallace, p. 23, of first English edition.

selection to determine the fit duration of life, as it would be impossible for it to fix any other character, unless that character were inherited. Accordingly the hypothesis above referred to supposes that duration of life is an inherited character. So far as we are aware, however, neither of the above-mentioned naturalists, nor any other investigators, have published researches bearing on the problem of whether duration of life is or is not inherited. We are accustomed to hear of a particular man that "he comes of a long-lived family", but the quantitative measure of the inheritance of life's duration does not yet seem to have been determined. This absence of investigation appears the more remarkable as a knowledge of the magnitude of inheritance in this respect would, we should conceive, be of primary commercial importance in the consideration of life insurance and of annuities. The biological interest of the problem, as we have already noticed, is very great.

2. It will be well in the first place to point out that the problem is by no means an easy or a straightforward one. The ages at death of even close relatives must be found from records of some kind, or else collected *ab initio*. Now if we take records like the Peerage, Baronetage, Landed Gentry, family histories, and private pedigrees, we find various serious omissions. In the first place the ages of the women are rarely given; pages of the Peerage or Landed Gentry may be examined before a single record is found of the ages of two sisters at death, or even of a mother and a daughter. Further, the census and other returns show how liable we are to find women's ages given erroneously. Family histories and pedigrees suffer in the same way; the pedigrees are mostly taken through the male line, and the women's ages can only be found in rare cases. An exception must be made in the case of the Quaker family histories, such as those of the Backhouse, Whitney, and other families. Here the data are as full for the women as for the men, but naturally the history of a single, even much-branched family, does not provide anything like the material that the Peerage and Landed Gentry do in the case of men. For this reason our first study is confined to inheritance of longevity in the male line. We hope eventually to collect enough data for inheritance in the female line, but it will take a longer time to amass, and we fear will scarcely be as homogeneous.

In the second place, the sources to which we have referred omit more or less completely all record of *the ages at death of*



*infants and children.* The Quaker records give better results than the Peerage, but even here the great bulk of child-deaths appears to remain unrecorded. Out of 1,000 males born in this country, more than 300 die before they are 20 years of age. But when 1,000 cases of ages of father and son were taken out of the Landed Gentry, only 31 cases showed the death of a son before 20 years of age. Of 2,000 brothers from the Peerage in 1,000 pairs, only 21 individuals died before 20 years of age. In the Quaker histories we found about 16 per-cent of deaths before 20 years of age. Clearly such early deaths are not represented in anything like their proper proportions. They will have to be found from other sources; possibly from direct inquiry, and the issue of data cards. We were thus compelled to limit this first study to the case when both relatives die at a greater age than 20. In the case of fathers, when we are dealing with the correlation between father's and son's ages at death, this is practically no limitation at all, as no father dying under 20 years of age was met with. In the case of the offspring, however, the limitation cuts off the distribution somewhat abruptly with a finite ordinate at 20—25, five years being our unit of grouping.

3. Now duration of life is a very different character to eye-colour, or to some extent to the size of organs in adult life. Eye-colour is fairly well determined; it may change with old age slightly, but it cannot transform itself from light blue to brown. Again, nourishment and use undoubtedly affect the size of organs, but they are likely to influence father and son, or, at any rate, brother and brother, in much the same way, for they are members of the same family and the same class. On the other hand, death depends not only on inherited constitution but on innumerable chance elements of environment and circumstance. The environment both of home and period is much more alike for two brothers than for a father and son; food, sanitation, habits of life, change considerably in a generation, and two brothers have more equal chances of life than a father and son. But even with two brothers, one may live on the family estates and the other ruin his health in Africa or India. Hence, while the non-differential death-rate will not materially alter the correlations between most characters in relatives, it must seriously affect the correlation between the durations of life in father and son, and to a lesser extent between brother and brother. A good stock may be better protected against death than a weak one, but no stock at all can resist certain attacks. Hence if we look upon death as a



marksman,  $p$  per-cent of his shots are, we may say, sure to be effective whatever they hit; this is the non-differential death-rate; the remaining  $100-p$  per-cent of his attacks will only be successful on the weaker stocks. Now the effect of this conception of death's action is that the correlation table for ages at death of any pair of relatives must be looked upon as a mixture of uncorrelated material—deaths due to the non-differential death-rate, and correlated material—deaths due to the differential or selective death-rate. At different periods of life, also, one of these death-rates may give more material to the table than at another. In the case of fathers and sons we should expect the non-differential death-rate to be more numerous in its contributions than in the case of brother and brother.

Now it has been shown by one of us that when correlated material is mixed with uncorrelated material, the result is approximately to reduce the coefficient of correlation in the ratio of the amount of correlated to the total amount of material.\* Hence, if we assume that the actual correlation between constitutional strengths to resist death would be given, at any rate approximately, by the values determined for other characters in a memoir on the Law of Ancestral Heredity,† we have clearly a method of to some extent ascertaining the proportion of the selective and non-selective death-rates in man. In the sequel, it will be shown that from the age of 20 to the end of life our tables give a correlation between the duration of life of father and son of about 0.12 to 0.14, and between brother and brother of about 0.26. According to the law of Ancestral Heredity we should expect these quantities to be about 0.3 and 0.4. Hence we conclude that the amounts of correlated material in the two cases are 40 to 50 per-cent and 65 per-cent. But if  $pN$  be the number of cases in which the death-rate is selective for  $N$  individuals,  $p^2N$  will be the number of cases for which it is selective when we take pairs of individuals. In other words, the selective death-rate in the first case‡ is about 63 to 70 per-cent, and in the second about 80 per-cent of the total death-rate. Without laying great stress on the actual numbers just stated, we think that they are sufficiently close to demonstrate that a substantial selective

\* *Phil. Trans.*, vol. 192, p. 277.

† *Roy. Soc. Proc.*, vol. 62, pp. 397 and 400.

‡ This selective death-rate from the data for father and son must be interpreted in the sense indicated above. The drop from 80 to 65, say, per-cent is in itself a measure of the change of environment of the two generations.

death-rate actually exists at work on mankind, and that with like environment it may amount to as much as four times the non-selective death-rate.\* In other words, having demonstrated that duration of life is really inherited, we have thereby demonstrated that natural selection is very sensibly effective among mankind. The natural selection we are here dealing with is not in the first place, of course, a result of any struggle of individual with individual; but of individual with environment and with the defects of personal physique.

4. In order to show the biological importance of investigating the inheritance of duration of life, we have cited the results obtained for correlation between the ages at death of father and son and brother and brother. But the method by which these results were obtained requires further discussion. We have already seen the need to exclude deaths under 20 years, but even then we have not got in the case of father and son two like groups of material. The father has been more severely selected than the son. He has lived to become a father, and he is strong enough to be the father of a son who lives to be 20 years of age. Evidence of this selection is to be found in the facts that (1) fathers have a mean age 5 to 7 years greater than that of their sons; (2) the variability of their age at death is very sensibly less than the variability of their sons' age, *i.e.*, as 2.9 to 3.5; or (3) by noticing for example that in our first table 82 sons as against 20 fathers die before 32.5 years of age, and that in our second table some 100 sons as against 20 fathers die before 35 years of age. Clearly the group "son" is a much weaker type than the group "father." As will be shown in a memoir on the effect of selection on correlation, this want of likeness in fathers and sons itself tends to modify the correlation between them.†

While this selection occurs only in the case of fathers and sons and not in the case of brethren, still the general character of the correlation surface is alike in both. It is known that the

\* The correlation on which this determination is based might be illusory, if families were reared under very individual environments; the correlation in duration of life of brothers, for example, might then be a result of their individual family environment. But the environment when we take comparatively homogeneous classes like the Peerage or Landed Gentry must be very similar, and we think this source of error, suggested to us by Professor Weldon, while very real, has been sufficiently provided against.

† Not of course very largely, still, with the values given in the first series of fathers and sons, the correlation would be reduced about 0.86 to 0.9 of its value by the selection of fathers.

curve of frequency of death at different ages\* is by no means normal. It is probably compound, and only approximates to normality round three score years and ten. It would hardly, however, fulfil a useful purpose to deal only with the correlation of ages of death of relatives both dying under the old age mortality group, even if on the sunny side of 70 we could distinguish old age from middle age mortality. But in dealing with correlation and regression in such cases as this, we must throw entirely on one side any notion of normal surface and curves of error, and go simply to the kernel of the affair.

What we want is the law connecting the mean age at death of one relative when another relative has died at a given age. When the given age of the latter and the mean age of the former are plotted to form a curve, this curve is the regression curve whatever be the form of the frequency surface. The line of closest fit to this curve is the regression line, and Yule's theorem† tells us that the slope of this line is found in exactly the same way as if the frequency surface were a normal distribution. The slope of this line has nothing whatever to do with the particular form of surface, and may be found even if we cut off a portion of the surface parallel to one axis, *e.g.*, if we take the regression line for fathers or sons we get the best fitting lines in precisely the same manner whether we take all sons dying from infancy to old age, or only those from 20 years onwards. If, of course, the regression curve is sensibly linear, then the regression line is the true curve of regression. Everything proved in the memoir, "On the Law of Ancestral Heredity"‡ holds for such linear regression equally well; we need not suppose normal correlation. Now the reader has only to look at our regression diagrams, in particular at that for brethren, to assure himself that no curve will serve for practical purposes substantially better than a straight line. Now, if  $\sigma_x$  be the standard deviation of the relative whose mean age at death is taken, and  $\sigma_y$  of the relative of a given age at death, and  $r$  be the correlation defined by

$$r = S \{ z(x - m_x)(y - m_y) \} / (N\sigma_x\sigma_y),$$

where  $z$  is the frequency of deviations  $x - m_x$  and  $y - m_y$  from the means  $m_x$  and  $m_y$  in the total observations  $N$ , then the line of closest fit, the regression line, passes through  $m_x$  and  $m_y$ , and has

\* *Phil. Trans.*, vol. 186, p. 406 and plate 16.

† *Roy. Soc. Proc.*, vol. 60, p. 480.

‡ *Roy. Soc. Proc.*, vol. 62, p. 386.

$r\sigma_x'\sigma_y$  for its slope. All this is independent of any theory of frequency distribution, and the vanishing of  $r$  with the correlation simply flows from the fundamental problem that the chance of a combined event is the product of two independent probabilities. Our conclusions in this paper are deduced from the above value of  $r$  and from the slope of the regression line, and they involve no further assumption than the approximate linearity of the regression curves. Our appeal to the memoir, "On the Law of Ancestral Heredity" makes also no greater demands.

5. We now turn to the material itself. Our data consists of three series, from which all deaths recorded as accidents, an exceedingly small proportion of the whole, were excluded. In excluding these, we of course, slightly, but very slightly, reduced the non-selective death-rate. In the first series, 1,000 cases of the ages of fathers and sons at death, the latter being over 22·5 years of age, were taken from *Foster's Peerage*; in the second series 1,000 pairs of fathers and sons, the latter dying beyond the age of 20, were taken from *Burke's Landed Gentry*; and in the third series the ages at death of 1,000 pairs of brothers dying beyond the age of 20 were taken from the *Peerage*.

The first series was obtained by grouping all fathers dying between 22·5 and 27·5, 27·5 and 32·5, &c. We started at 22·5 because this was the earliest recorded death of a father among those extracted from the *Peerage*, and to have sons dying in the same range they were also started at 22·5 years. In extracting the ages at death, they were taken to the nearest whole year, and consequently in the subsequent grouping we were spared decimals. In the second and third series we originally took all deaths from births onwards also to the nearest whole year, and then grouped in five-year periods; thus fractions were introduced when a death fell on a five-year division. Subsequently we eliminated the few deaths occurring before 20 years of age.

The aggregate material for the three series is given in Tables I, II, and III; and the means of the arrays of fathers' ages at death for sons dying at a given age, *i.e.*, the regression polygons of fathers' on sons' age at death in figs. 1 & 2; the regression polygon for brethren is given in fig. 3.

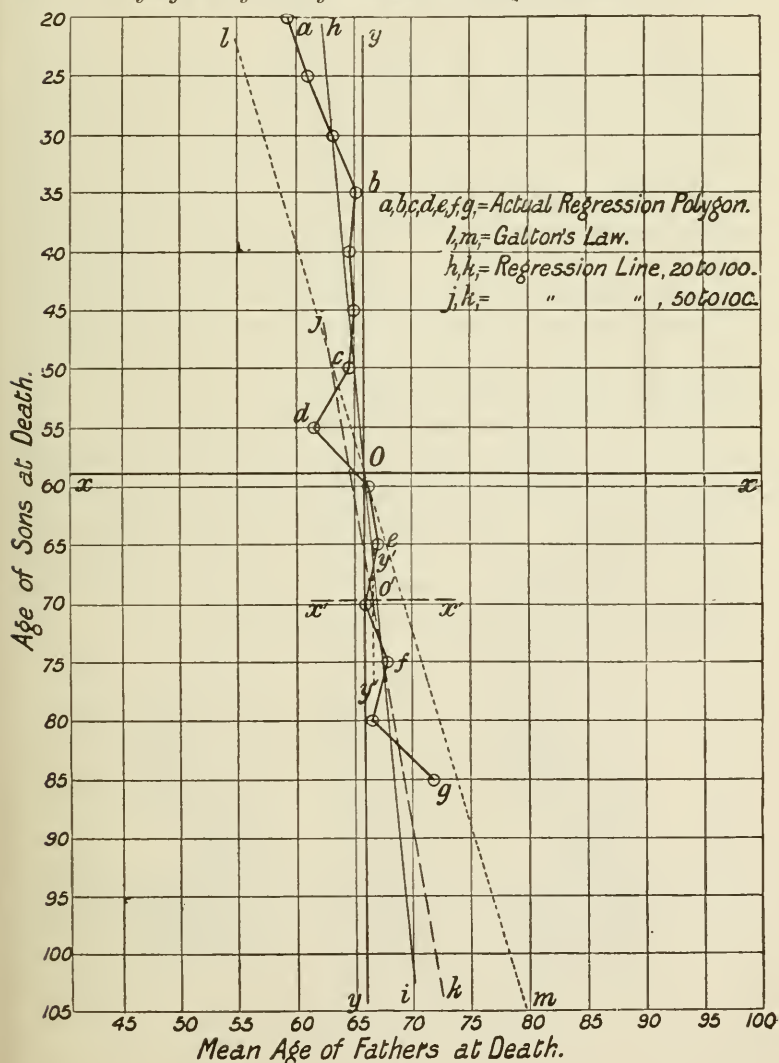
In the case of brothers, we have rendered the original distribution, which was nearly symmetrical, absolutely symmetrical, by entering into the table each pair of brothers twice, an individual first appearing as a first brother and then as a second brother. Thus the mean age at death and variability of age at death of



both sets of brothers appears the same, and we have a nominal 2,000 instead of 1,000 entries. Of course, in calculating the probable errors of the constants, 1,000 has been taken as the number of observations. We shall now consider these diagrams and tables a little at length.

6. *First Series.*—The means of the arrays of fathers for a given age at death of the son, are shown by the broken line *bcdefg* in fig. 1.

FIG 1.—Diagram giving Mean Age of Fathers at Death for Sons dying at a given age. First Series, 1,000 cases.





The point *a* for the group of sons dying between 17·5 and 22·5 years was put in from a few observations not afterwards included in the table. Beyond the group 82·5 to 87·5 years, there were not sufficient observations to form a reliable mean at all: *yy* gives the mean age of all the 1,000 fathers observed, and represents 65·835 years; *xx* gives the mean age of the 1,000 sons, and represents 58·755 years. The former may be taken as the mean age at death of all fathers, the latter was only the mean age at the death of sons who live more than 22·5 years. The regression curve is a somewhat broken polygon, but one or two points may be deduced at once from it.

(a) It is entirely to the left of *yy* above *xx* and entirely to the right of *yy* below *xx*. Thus there is certainly correlation between the ages at death of father and son. A son dying below the mean age will have on the average a father dying below the mean age, and a son dying above the mean age will have on the average a father dying above the mean age. Graphically we see that correlation must exist. The straight line which best fits the regression polygon is given on the diagram by *hi*. The law of Ancestral Heredity would give *lm* with a slope of 0·3. It is clear that with a quite sensible regression there is a quite sensible divergence from the law of inheritance, in other words, the death-rate is only in part selective.

Quite similar results are to be observed in fig. 2; there is again a very sensible correlation, but it is sensibly less than that required by the Law of Ancestral Heredity. The lines are lettered the same. Numerically, if  $M_S$ ,  $M_F$  be the mean ages at death of sons and fathers,  $\sigma_S$ ,  $\sigma_F$  their standard deviations,  $r_{SF}$  their correlation,  $R_{SF} = r_{SF} \sigma_S / \sigma_F$ ,  $R_{FS} = r_{SF} \sigma_F / \sigma_S$  the regression coefficients of son on father and father on son, we have—

FIRST SERIES		SECOND SERIES	
"Peerage," Fathers and sons, 25 years and on		"Landed Gentry," Fathers and sons, 20 years and on	
65·835 years	$M_F$	65·9625 years	
58·775 "	$M_S$	60·9150 "	
14·6382 "	$\sigma_F$	14·4308 "	
17·0872 "	$\sigma_S$	17·0986 "	
$0·1149 \pm 0·0210$	$r_{SF}$	$0·1418 \pm 0·0209$	
$0·0985 \pm 0·0182$	$R_{FS}$	$0·1196 \pm 0·0178$	
$0·1341 \pm 0·0367$	$R_{SF}$	$0·1682 \pm 0·0371$	

Now these results extracted from very different records are in good accordance. The values of the correlation and regressions are five to seven times the magnitudes of their probable errors, and they agree within the probable error of their differences. The only significant difference is the mean age of deaths of sons in the Landed Gentry which is some two years higher than in the Peerage. This is the more noteworthy, in that we have begun our peerage record at 25 and not 20. Clearly the sons of the Landed Gentry are longer lived. We have undoubtedly correlation, say somewhere about 0.12, sensible and definite in amount, but clearly considerably below the 0.3 required by the law of inheritance.

(b) A second point may be noticed by looking at the diagrams (1) and (2), namely, that from about the age of 32.5 to 52.5 the regression line is sensibly vertical, or when the son dies in middle life, the mean age of death of the father is sensibly uncorrelated with it. In other words, we have the remarkable result that the mortality which, in a paper on skew variation by one of us,\* has been termed that of middle life, is largely uninherited. It is during this period of life that the non-selective death-rate is chiefly predominant. After this period the regression curve becomes sensibly steeper, although not fully up to the steepness of the line given by Galton's Law. This is more properly the inheritance of *longevity*. The inheritance of duration of life may not be continuous.

If we seek the best fitting straight line for the regression polygon from 50 years onward we find:

FIRST SERIES		SECOND SERIES	
"Peerage", 52.5 years of son and on		"Landed Gentry", 50 years of son and on	
66.680 years	$M_F$	66.878 years	
69.686 "	$M_S$	68.960 "	
14.6734 "	$\sigma_F$	14.3273 "	
9.6148 "	$\sigma_S$	10.4055 "	
$0.1156 \pm 0.0232$	$r_{FS}$	$0.1125 \pm 0.0243$	
$0.1764 \pm 0.0380$	$R_{FS}$	$0.1549 \pm 0.0333$	

Results such as these are as close as we could expect, and they mark an increase in the steepness of the regression line from

\* *Phil. Trans.*, A, vol. 186, p. 408, and Plate XVI.

about 0.11 to 0.17, an undoubtedly substantial increase of the selective death-rate as we approach old age. The regression line for this old age mortality is marked as *jk* in diagrams (1) and (2), and we see the advance towards the Galtonian value.

(c) Below 32.5 years the regression line in figs. 1 and 2, especially the former, seems to indicate increased correlation again, but unfortunately our records do not give enough data to determine its form in a reliable manner.

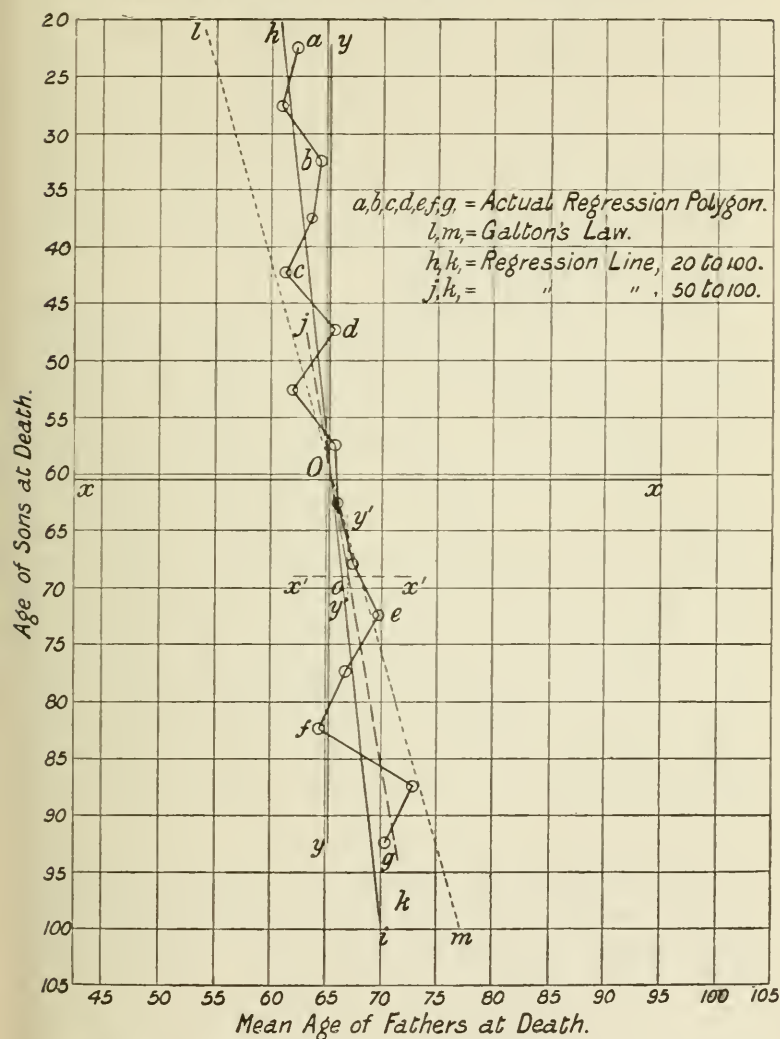
Fig. 1 seems to indicate a great approach to the Galtonian value towards youth, and we should not be surprised to find the selective death-rate in youth and infancy even more predominant than in old age. This would be the inheritance of the reverse of longevity, of "brachy-bioly." The regression curve for this portion of life cannot be determined from our present statistics, but we hope to return to it in a second study when more data have been collected.\* So far as we are able to judge at present the inheritance of the duration of life breaks up into two parts, an inheritance telling its tale in youth, and another after middle life. It is the former part which seems to us to have most bearing on the fertility and survival of stocks, most individuals having reproduced themselves by 50 years of age. It is the latter part only, the true inheritance of longevity, to which it would appear that Weismann and Wallace's arguments apply: †

"For it is evident that when one or more individuals have provided a sufficient number of successors, they, themselves, as consumers of nourishment in a constantly increasing degree, are an injury to those successors. Natural selection therefore weeds them out, and in many cases favours such races as die almost immediately after they have left successors."

\* This collection has already commenced, and we hope shortly to give more definite information on this point.

† Wallace, *loc. cit.*, *supra*.

FIG. 2.—Diagram giving Mean Age of Fathers at Death for Sons dying at a given Age. Second Series, 1,000 cases.



We now turn to the third series, giving the correlation between the ages of death of brothers. The data give the following numerical results:

$$M_B = 60.971 \text{ years}$$

$$\sigma_B = 16.8354 \text{ ,,}$$

$$r_{BB} = 0.2602 \pm 0.0199$$

$$R_{BB} = 0.2602 \pm 0.0216.$$

The results here are in good agreement with those for sons in the Landed Gentry, *i.e.*, in the second series. The mean age of one of a pair of brothers is slightly greater, and the variability of one who has a brother slightly less than in the case of sons. But this is exactly what we might expect, considering that "brothers" are a selection from "sons", and a brother is likely to have greater vitality than a son. The group sons covers sons of fathers who did not live to have more than *one* son, and who therefore came of any early dying stock, while brothers denotes at least two sons, and therefore on the average some years more life than is necessary for one son.

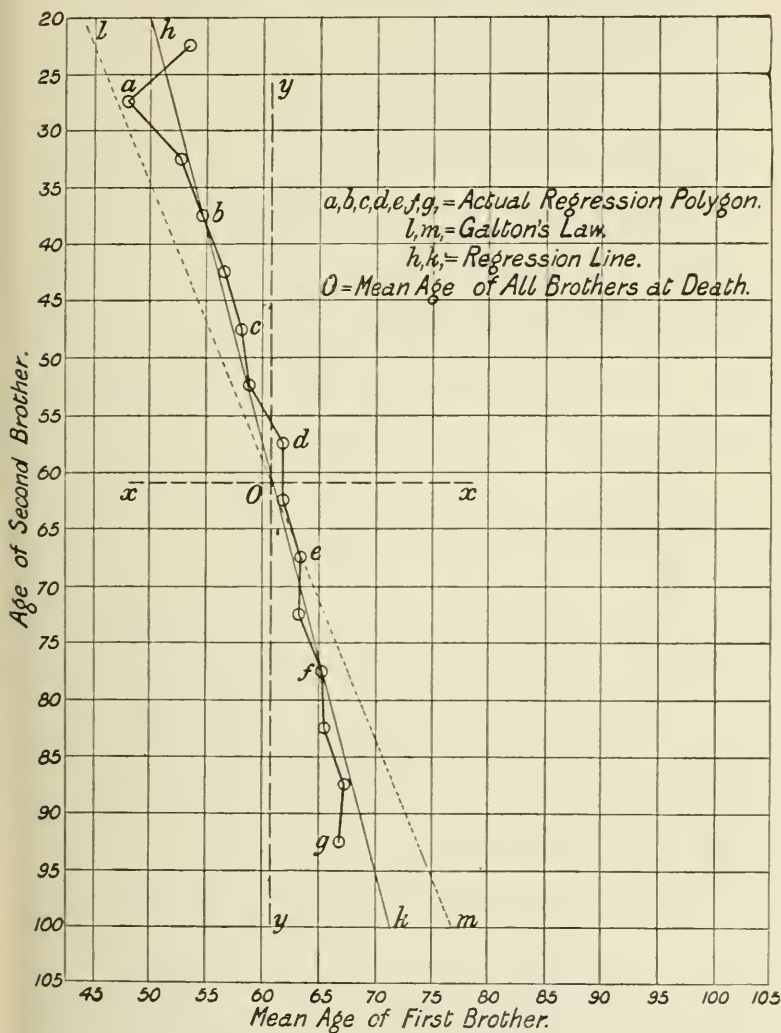
The values of the coefficients of correlation and regression are some 13 times their probable errors, and we have a substantial correlation, approaching much closer than in the case of sons to the value demanded (0.4) by the Law of Ancestral Heredity. The diagram shows (i) how substantial is the correlation; (ii) how much more nearly the regression line  $kk$  given by observation approaches the theoretical line  $lm$ ; and (iii) how very nearly the regression curve is truly linear. The reason of this closer approach to the theoretical value of heredity is owing to the diminution in the non-selective death-rate, the environment of brothers during their lives being as a rule much more alike than that of father and son. It must be noted that the predominance of the non-selective death-rate in middle life, so marked in the latter case, no longer appears in the case of brothers. This would suggest that the environments of father and son differ most in middle life and are then much more unlike than those of brothers.

7. We conclude this first study by putting on record formulæ for estimating the age at death of a man, using the theory of multiple correlation as developed in a memoir\* by one of the present writers, and taking as basis the second and third series, which seem to us to present the best results.

\* "Contributions to the Mathematical Theory of Evolution. III. Regression, Heredity, and Panmixia", *Phil. Trans.*, A, vol. 187, pp. 253-318.



FIG. 3.—Diagram giving the Mean Age of Man at Death for a Brother dying at a given Age. 1,000 cases.



Let  $P$  be the probable age in years at death of a man,  $F$  be the age at death of his father,  $S_1$  of his first son,  $S_2$  of his second son,  $B_1$  of his first brother,  $B_2$  of his second brother. Then we have the following cases:

*Prediction of Age at Death.—All Deaths after 20 years.*

- (a) From age of father at death—  
 $P = 49.8201 + 0.1682 F,$   $\Sigma = 16.9259$
- (b) From age of brother at death—  
 $P = 45.1063 + 0.2602 B_1,$   $\Sigma = 16.2555$
- (c) From age of son at death—  
 $P = 58.6771 + 0.1196 S_1,$   $\Sigma = 14.2850$
- (d) From ages of father and brother at death—  
 $P = 37.6647 + 0.12685 F + 0.24502 B_1,$   $\Sigma = 16.4099$
- (e) From ages of father and son at death—  
 $P = 48.7991 + 0.15706 F + 0.11168 S,$   $\Sigma = 14.1573$
- (f) From ages of two brothers at death—  
 $P = 35.7930 + 0.206475 (B_1 + B_2),$   $\Sigma = 15.9052$
- (g) From ages of two sons at death—  
 $P = 54.3928 + 0.09497 (S_1 + S_2),$   $\Sigma = 14.1987$
- (h) From ages of brother and son at death—  
 $P = 44.2601 + 0.1046 S + 0.2514 B,$   $\Sigma = 13.8508$

Here  $\Sigma$  is the standard deviation of the array of men for each group. Such formulæ\* seem to us to give a quantitative accuracy to much that is allowed rather indefinite weight at present in the actuarial and medical professions. Based on a wider mass of data and a larger series of relationships, we cannot but believe they would be of much help to the physician and actuary. If their importance were once recognized by the insurance offices, we believe that the necessary data would be readily forthcoming. As illustrations take the following:

(i) A man's father dies at 40, and his brother at 25. What is the probable reduction in his own life? *Answer*: 12 years.

\* In obtaining the formulæ for prediction from the age at death of two relatives, certain assumptions have had to be made. Thus the correlation of ages of a man and his grandfather and of a man and his uncle at death, being at present unknown, were taken to be half the correlation of father and son. This cannot be far wrong, but the actual values ought to be found. We did not feel justified in assuming the variability of grandfathers, which must be less than that of fathers, or their mean age at death, which must be greater than that of fathers, in order to determine the probable age at death of a man from that, say, of his grandfather and father, which would be of much interest. We only wish to draw attention to what we believe to be a new and important field of enquiry and to indicate the nature of its problems.

(ii) A man has two brothers, who die young, at 25 and 29. How much will this shorten his probable duration of life? *Answer*: 14 years.

(iii) A man's father died at 40, and his brother, his senior by one year, died at 50, 22 years ago. A life estate now accrues to the man, whose whereabouts are unknown. What is the probability that he is still alive, and should he return and claim the estate how long is he likely to enjoy it? *Answer*: The man belongs to an array of men of mean age 54.99 years at death, and standard deviation 16.41 years. Hence the odds against his living beyond 71 years are 835 to 165, and, accordingly, the odds against the possibility of his return are about 21 to 4. Should he be alive and return, he is as likely as not to hold it for 6.8 years, and 8.7 years is his expectancy of life, so that the contingency of his being alive and enjoying the estate is worth only about 1.4 years' income of the estate.

Clearly, such problems can be extended in a great variety of ways which might be serviceable in actuarial practice.

I.—*Correlation Table for the Inheritance of Longevity from Father to Son.—First Series.*

	AGE OF FATHER AT DEATH																	Totals
	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	
20																		
25	1	..	1	3	1	1	9	4	3	5	4	3	1	1	..	..	..	37
30	1	..	3	1	4	1	6	2	6	3	10	5	2	1	..	..	..	45
35	..	..	1	2	4	6	4	5	10	6	6	5	7	..	1	..	..	57
40	..	1	5	2	3	5	6	6	11	7	17	11	2	1	..	..	..	77
45	..	1	2	2	3	3	5	6	11	11	8	6	4	1	..	..	..	63
50	1	2	2	1	3	7	13	10	4	8	14	11	7	1	..	..	..	84
55	1	2	3	5	5	8	10	7	6	12	9	8	5	2	..	..	..	83
60	1	1	..	2	2	6	9	6	7	17	13	10	2	2	1	..	..	79
65	..	1	2	5	5	4	11	10	5	18	18	14	10	4	..	..	..	107
70	..	2	3	1	4	10	9	12	23	9	20	12	10	3	1	..	..	119
75	3	1	2	4	3	9	6	10	8	20	23	13	10	6	2	..	..	120
80	1	..	3	1	3	2	6	3	6	9	10	6	8	1	..	..	..	59
85	..	..	..	1	2	1	3	2	6	6	10	8	8	2	1	..	1	51
90	..	..	1	..	2	..	2	2	..	2	2	3	..	..	..	..	..	14
95	..	..	..	..	..	..	..	..	2	..	1	..	1	..	..	..	..	4
100	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0
105	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Totals	9	11	28	30	44	64	99	85	108	133	165	115	77	25	6	0	1	1,000

II.—Correlation Table for the Inheritance of Longevity from Father to Son.  
Second Series.

		AGE OF FATHER AT DEATH																Totals	
		20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55	55 to 60	60 to 65	65 to 70	70 to 75	75 to 80	80 to 85	85 to 90	90 to 95	95 to 100		100 to 105
20 to 25	...	...	...	1.5	3.0	2.0	3.5	5.25	1.25	4.5	6.5	4.0	2.0	...	...	...	...	...	33.5
25 " 30	...	...	...	2.0	3.0	1.75	4.25	4.25	1.75	4.25	4.75	4.5	1.0	...	...	...	...	...	31.5
30 " 35	1	...	...	1.5	1.0	1.75	5.75	1.0	2.5	5.25	3.75	4.0	4.25	1.25	...	...	...	...	33.5
35 " 40	...	0.25	2.25	3.0	1.0	1.5	1.5	7.0	5.0	6.5	1.5	7.0	2.75	2.25	...	...	...	...	42.5
40 " 45	...	0.25	0.75	1.5	4.5	2.5	9.5	5.75	8.25	6.0	5.0	3.0	1.0	1.5	...	...	...	...	50.5
45 " 50	...	2.0	0.5	...	1.0	2.5	9.25	4.5	10.0	3.75	8.0	6.25	6.0	5.75	...	...	...	...	60.0
50 " 55	...	...	...	4.25	7.75	6.5	10.75	7.75	10.75	12.25	7.5	11.5	5.25	0.75	...	...	...	1	86.0
55 " 60	...	...	...	3.25	3.75	3.25	9.5	10.25	9.5	10.5	11.75	17.0	5.75	4.5	...	...	...	...	89.5
60 " 65	...	1.0	3.0	2.5	2.5	4.75	3.5	10.25	11.5	12.5	12.75	19.75	5.75	3.0	1.25	...	...	...	94.0
65 " 70	...	2.25	1.25	3.0	6.0	4.0	7.0	12.0	12.5	22.75	18.0	20.25	10.75	9.25	4.75	0.25	...	...	133.0
70 " 75	...	1.25	1.25	0.5	2.75	4.75	5.0	10.5	16.25	13.75	10.75	23.25	14.25	7.75	3.75	0.75	1	...	117.5
75 " 80	...	...	2.0	1.5	4.75	11.5	8.25	8.0	20.25	11.5	12.5	12.25	13.0	10.25	2.75	1.0	...	...	119.5
80 " 85	...	0.5	1.0	3.5	1.0	3.25	5.25	8.0	6.5	7.0	7.5	7.0	2.75	3.25	2.0	...	...	...	59.0
85 " 90	...	...	...	0.5	2.0	1.5	1.5	0.5	3.0	3.5	4.75	6.5	6.75	6.0	...	1.0	...	...	37.5
90 " 95	...	...	...	...	...	...	...	1.0	1.0	1.0	1.0	5.75	2.75	1.0	...	...	...	...	10.0
95 " 100	...	...	...	...	...	...	...	...	...	...	1.5	...	...	...	...	...	...	...	1.5
100 " 105	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.0
Totals .	1	7.5	12.0	29.0	44.0	51.5	85.5	96.0	120.0	125.0	117.5	147.0	84.0	56.5	18.5	3.0	2	1,000.0	

III.—*Correlation Table for the Inheritance of Longevity in Brethren.*  
*Symmetrical Table, 1,000 Cases as 2,000.*

		AGE OF FIRST BROTHER AT DEATH																Totals	
		20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55	55 to 60	60 to 65	65 to 70	70 to 75	75 to 80	80 to 85	85 to 90	90 to 95	95 to 100		100 to 105
20 to 25	...	3.5	15.0	3.5	3.5	3.5	3.5	3.5	...	4.5	1.25	3.5	3.0	0.75	0.5	1.0	...	...	34.0
25 " 30	3.5	15.0	3.5	3.0	3.5	3.5	6.0	5.5	3.0	3.0	4.75	1.5	5.0	2.75	1.5	...	...	...	64.5
30 " 35	3.5	5.0	11.5	7.75	6.5	5.75	5.75	8.75	4.0	4.0	9.0	7.5	6.0	2.5	3.0	0.5	...	...	88.0
35 " 40	3.0	4.5	7.75	7.0	7.0	7.75	11.25	8.25	9.0	12.0	13.0	13.0	2.5	3.0	1.0	0.5	...	...	97.5
40 " 45	2.5	3.0	6.75	7.0	10.5	11.25	10.0	7.0	16.0	16.0	6.0	14.75	4.75	8.0	1.0	1.0	...	...	109.5
45 " 50	3.5	3.5	6.5	7.75	11.25	20.5	7.75	9.25	12.75	17.25	22.25	12.25	12.75	9.0	5.5	2.75	...	...	140.0
50 " 55	3.5	6.0	5.75	11.25	10.0	7.75	14.0	14.25	15.0	19.0	22.5	13.25	25.25	11.5	6.5	1.5	...	...	152.0
55 " 60	...	5.5	8.75	8.25	7.0	9.25	14.25	15.0	19.0	21.5	32.5	22.25	19.5	17.0	7.75	1.5	...	...	167.5
60 " 65	4.5	3.0	4.0	9.0	16.0	12.75	17.25	19.0	21.5	32.5	28.5	31.25	26.25	16.0	13.75	3.75	...	...	207.5
65 " 70	1.25	4.75	9.0	12.0	6.0	11.25	22.25	22.5	32.5	32.5	31.25	38.0	27.0	21.75	10.75	1.5	...	...	241.0
70 " 75	3.5	5.0	7.5	13.0	14.75	22.25	12.25	13.25	22.25	22.25	31.25	38.0	27.0	21.75	12.0	3.75	...	...	240.5
75 " 80	3.0	6.0	6.0	2.5	4.75	15.5	12.75	25.25	19.5	19.5	26.25	27.0	34.5	19.75	12.0	3.75	...	...	217.5
80 " 85	0.75	2.5	3.0	3.0	8.0	5.5	9.0	11.5	17.0	17.0	16.0	21.75	19.75	14.5	5.5	2.0	...	...	139.5
85 " 90	1.5	3.0	1.0	1.0	1.0	2.75	5.5	6.5	7.75	7.75	13.75	10.75	12.0	5.5	8.0	2.0	...	...	81.5
90 " 95	...	...	0.5	0.5	1.0	...	...	1.5	1.5	1.5	3.75	1.5	3.75	2.0	2.0	...	...	...	19.5
95 " 100	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
100 "	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals	34.0	64.5	88.0	97.5	109.5	140.0	152.0	167.5	207.5	241.0	240.5	217.5	139.5	81.5	19.5	...	...	...	2,000.0



*The Decennial of the Actuarial Society of America.*

[Mr. ISRAEL C. PIERSON has been good enough, at our request, to contribute the following notes on the Decennial Celebrations of the Actuarial Society of America. From its commencement, until 19 May 1899, Mr. Pierson was the indefatigable Secretary of the Society. He is now one of its Vice-Presidents.]

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THE Institute of Actuaries had been in existence forty-one years when the first decisive steps were taken by the actuaries of America to form an Association for the promotion of the Science of Life Insurance. It happened that in February 1889, Messrs. David Parks Fackler, Clayton C. Hall, Sheppard Homans, Emory McClintock, and Howell W. St. John (the third and fourth being respectively a Corresponding Member and a Fellow of the Institute), independently thought of proposing an organization of actuaries. Somewhat by accident their ideas were intercommunicated. On the request of the four other gentlemen, Mr. Fackler sent letters to the actuaries of the regular Life Insurance Companies in the United States and Canada, which called forth replies cordially favourable to the project. Accordingly, in response to an invitation of actuaries resident in New York, on 24 April 1889 twenty-nine of the actuaries met at the Astor House in New York, and, after a conference which exhibited a marked unanimity, founded the Actuarial Society of America. On 25 April, they adopted a Constitution and elected officers. Nine others, who could not be present, immediately afterwards signified their acquiescence in the organization, and subscribed to the Constitution, thus making thirty-nine Charter members. The Constitution declared the object of the Society, and provided for membership (one class), Officers and Council, an Annual Meeting in April, and other meetings as called by the Council, &c. Naturally, with the development of the Society, this Constitution has been amended somewhat.

By vote of the Council, the Society was convened in New York on 3 October 1889, since which time a meeting has been held in the fall as well as in the spring of each year.

Including the Decennial, 25 semi-annual meetings have been held. The Annual Meeting has always been held in New York

in the spring, the special business being the election of officers, President, 1st and 2nd Vice-Presidents, Secretary, and Treasurer, and Members of the Council. The officers are chosen for one year, the President and Vice-Presidents being eligible for re-election once. The Council consists of the officers, ex-Presidents in perpetuo, and six other members who are divided into three classes, two being chosen at each election for a period of three years. The Presidents have been re-elected in each case and in the order indicated, Messrs. Sheppard Homans, David Parks Fackler, Howell W. St. John, Emory McClintock and Bloomfield J. Miller. Mr. Thomas B. Macaulay was chosen President of the Society at the Decennial Meeting.

The fall meeting is usually held in some city other than New York, specially selected, *e.g.*, Hartford, Toronto, Boston, Philadelphia, Montreal, Pittsfield, Springfield, and Worcester. It is characteristic of this meeting that it has been somewhat more social than the spring meeting, and has been instrumental in developing a strong friendship between the members.

For several years there was but one class of members, election to which required all but two votes of the Council and a three-quarter vote of the Society. Recently the Constitution was amended to provide for the admission of Associates, candidates for which must receive all but one vote of the Council and pass a prescribed examination. The principal other conditions are that the candidate shall be 21 years of age, pursuing actuarial studies, &c., it being the sentiment of the Society that only those who are or hope to become actuaries are eligible. After the lapse of a year, Associates may become Members on passing a final examination. Otherwise, no one can be admitted to membership, excepting by a unanimous vote of the Council followed by a unanimous vote of the Society.

The membership of the Society is distributed somewhat as to nationality. Of the 38 Charter members, 34 were from the United States and 4 from Canada. The number has been increased by 91, and diminished by 13 deaths (10 from United States, 2 from France, and 1 from Belgium), and 4 resignations and discontinuances (3 from United States, and 1 from Great Britain). At the date of the Decennial, there were 112 Members and Associates, 66 United States, 13 Canada, 19 Great Britain, 3 France, 2 Holland, 2 Belgium, 3 Australia, 3 New Zealand, 1 Japan.

Original papers presented at a meeting are discussed at the following meeting. This affords opportunity for careful consideration and discussion of the subjects. There is no loss of interest, and sometimes the discussion is more useful than the original article.

The Society has published twenty semi-annual numbers of the "Papers and Transactions", making five volumes with title page, a table of contents, a list of the members, and an index for each volume, a total of 2,073 pages.

In addition to the books received under the bequest of the late Wm. D. Whiting, the Society has a considerable accumulation, including the *Journal of the Institute* and the publications of other actuarial associations, mortality experiences, and reports of Companies, &c. It is the purpose of the Society to catalogue these books in the near future. Photographs of the individual members, of groups of members at meetings, and the two International Congresses of Actuaries constitute a valuable and interesting collection.

The President of the Society, with Messrs. David Parks Fackler, John Tatlock, Jr., and the Secretary, were appointed a committee to make special arrangements for the celebration of the completion of the first ten years of this Society. The officers of the Metropolitan Life Insurance Company very kindly offered the use of their directors' room for the meetings, and tendered a reception on the evening of the first day. The programme included sessions of the Society for the transaction of business, reading of papers, &c., during the day on 18 and 19 May—reception on the evening of the 18th and Decennial Banquet on the evening of the 19th.

Formal invitations to be present at the banquet were sent to the Presidents of the Life Insurance Companies of the United States and Canada, while cordial invitations were sent to all the foreign members, and to all other Actuarial Associations, especially to the Institute of Actuaries, the parent of all, and to the prominent delegates to the Congress of Actuaries, should any of them be able to attend.

Many were the letters expressing cordial sympathy and hearty congratulations, especially from the "Institute of Actuaries", the "Faculty of Actuaries", the "Actuarial Society of Edinburgh", the "Institute of New South Wales", the "Institut des Actuaire Français", the "Association des Actuaire Belges",

the "Vereeniging van Wiskundige-Adviseurs bij Nederlandsche Maatschappijen van Levensverzekering" and the "Associazione Italiana per l'incremento della Scienza degli Attuari", and prominent members of the Congress of Actuaries who also had been invited to be present. These messages were read to the Society at one of the sessions, and were received with hearty appreciation.

The officers of the Metropolitan Life Insurance Company entertained the members at luncheon on the two days of the business of the sessions. On the invitation of the President of the Metropolitan at the close of the morning session of the second day, a tour of inspection was made through the several departments, to see the office operations of the Company which, as to extent of industrial business, is second only to the Prudential of London.

A reception to the members of the Society on Thursday evening was given by the officers of the Metropolitan in the Directors' Room and Marble Court, which were elaborately decorated with palms and flowers and brilliantly illuminated by electric lights. Mr. John R. Hegeman, the President of the Company, assisted by Mr. Bloomfield J. Miller, President of the Society, received the 350 guests, members of the Society, ladies, officers of the companies, representatives of the insurance press, officials of State Insurance Departments, including Messrs. von Knebel Doeberitz and Marschall von Bieberstein, of the Prussian Government Department of Insurance. A delightful programme, furnished by a male quartette, contralto, reciter, and violoncellist, was followed by a supper in the annex of the large Metropolitan building. The flags of all nations covered the walls of the room and flowers ornamented the tables, while the orchestra discoursed pleasing music.

The crowning function of the Decennial celebration was the formal banquet in the Red Hall at Delmonico's, on Friday 19 May 1899, at 7 p.m., when 150 were present. Mr. Bloomfield J. Miller, the President of the Society, presided, and was toast-master. At his table sat the speakers of the evening. The Presidents of the life insurance companies were the guests of honour. Others present were the guests of the members, each one having been privileged to invite two.

It was a unique gathering, for never before had the Presidents or Executive Officers of the companies sat together at a general



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It was a unique gathering, for never before had the Presidents or Executive Officers of the companies sat together at a general

banquet of life insurance men. There were among the guests a few of the Medical Directors and also some from the agency departments. No reporter was present. During the banquet an orchestra furnished music, while between the toasts the Lotos Glee Club interspersed vocal selections.

The toasts were as follows :—

- I. "The President of the United States."  
"The Queen of Great Britain and Ireland."
- II. "The Guests." Mr. James W. Alexander, President  
"Equitable Life Assurance Society."
- III. "The Institute of Actuaries and Kindred Organizations." Mr. James Chatham, Actuary "Scottish Life Company", Edinburgh.
- IV. "The Popularization of Life Insurance." Mr. John R. Hegeman, President "Metropolitan Life Insurance Company."
- V. "The Life Companies." Hon. John A. McCall, President "New York Life Insurance Company."
- VI. "Germany, the Fatherland of the Anglo-Saxon Race." Herr von Knebel Doeberitz.
- VII. "Life Insurance a Factor in Civilization." Mr. Joseph Ashbrook, Manager "Provident Life and Trust Company", Philadelphia.
- VIII. "The Society an International Bond." Mr. John L. Blaikie, President "North American Life Assurance Company", Toronto.
- IX. "The Decennial of the Society." Mr. Charlton T. Lewis.

The active members of the Society being from the United States and Canada, it is the custom at all banquets of the Society to propose the toast first stated above.

Mr. David Parks Fackler having been instrumental more than any one else in bringing about the organization of the Society, on the request of the President, at the end of his opening remarks, gave a brief account of the founding.

It was a cause of deep regret that Mr. James Chatham, the

appointed Delegate of the "Institute of Actuaries", "Faculty of Actuaries", and "Actuarial Society of Edinburgh", could not be present according to his expectation, to respond to the toast "The Institute of Actuaries and Kindred Organizations." The President called upon Messrs. Emory McClintock and Thos. B. Macaulay, both Fellows of the Institute, to respond in the place of Mr. Chatham.

The responses to the toasts were excellent and listened to with unabated attention. It was after midnight when the last words were spoken and the Decennial celebration was ended.

ISRAEL C. PIERSON.

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## REVIEWS.

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### *Transactions of the Second International Actuarial Congress.\**

This volume possesses a twofold interest for members of the actuarial profession. As a record of the proceedings of the International Congress held last year in London—the ancestral home, if not the birthplace, of actuarial science—it has distinct historical interest, while as a compendium of information, contributed by experts from all parts of the civilized world, upon the important economical and social questions selected for consideration by the Organizing Committee of the Congress, it has scientific interest of a high order. The historical character of the work has been carefully preserved in the general arrangement of the contents, and its scientific value to students in the British Empire and America has been enhanced by the inclusion of English translations of the papers written in French (with the single exception of M. Landré's paper on Assurance Limits), and in German. A short account of the organization of the Congress and the official minutes of the proceedings occupy the first few pages of the volume; the Transactions follow in the order of the agenda, and the concluding proceedings of the Congress, a report of the speeches at the Institute of Actuaries' Jubilee Dinner, and a list of Officers and Members, complete the work. In a prefatory note Mr. T. E. Young directs attention to the "essentially *Practical* and generally serviceable Nature of the Congress", as exemplified (1) in regard to the important subjects of Old Age Pensions, Workmen's Compensation and Sickness Assurance, by the "collective presentation of facts as a basis of thought and of wise reconstruction", (2) in

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regard to life assurance legislation, by the exhibition of the relations obtaining between the State and Assurance enterprise in many countries, and (3) in regard to actuarial research and education, by the adoption of a systematized and consistent notation. Mr. Young's estimate of the scope and value of the Transactions of the Congress indicates their limitations while it justly appreciates their usefulness. Of the three processes which, according to Mr. Young's definition, constitute the essential function of science—namely, “the collection “and methodization of suitable data; the interpretation of their “teachings; and the formation, based upon such experience, of “improved schemes of realization”—the first alone appears to have been attempted in the majority of papers submitted to the Congress. With few exceptions the contributors have strictly confined themselves to the statement of facts, and have left severely alone the more difficult problems of interpreting these facts, or basing improved schemes of realization upon them. Materials for research rather than the results of research, data rather than deductions, constitute the characteristic feature of the Transactions. To this end the choice of subjects by the Organizing Committee naturally, and perhaps designedly, tended. The subjects of Old Age Pensions and Workmen's Compensation, for example, lie in that borderland between actuarial science and social politics where philanthropists may be ready enough to rush in, but where actuaries rightly prefer to tread with caution; experience has been “too brief to prove sufficiently indicative and adequately suggestive”, and the line of scientific advance in regard to these complex problems lies in the direction rather of an authoritative exposition—such as the Transactions contain—of the experiments that have been made in various countries than of premature attempts to construct a sound scheme from the available data. It must, however, be admitted that the absence of the constructive element from the majority of the contributions to the Transactions detracts from their topical interest, although not from their scientific value, and the task of the student in attempting to derive suggestive ideas from them is rendered additionally difficult by the somewhat unilluminating nature of the discussions. Some instructive comments of a general rather than a critical character were elicited by the papers on Legislation and Friendly Societies; but the discussion of the remaining subjects which came before the Congress rarely rose above the level of the purely perfunctory. It would have been surprising if it had been otherwise, for the intellectual surfeit provided at the Congress—to say nothing of its social incidents—must have occasioned a mental indigestion hardly favourable to the assimilation and just appreciation of a dozen papers a day; but the fact remains and suggests that the interest of the proceedings of a Congress would be materially increased if it were possible to publish the Transactions before the event, or, at any rate—by way of a practical compromise—to arrange beforehand for a critical discussion of the papers on each subject by two or three selected referees. Every student of the *Journal* will recall numerous instances in which the discussions on papers read before the Institute have afforded valuable assistance, and brought out important points.



As already indicated, the scientific value of the Transactions consists mainly in the material which they place at the service of the student. But to this general characterization of the contents of the volume, the papers submitted on the first day of the Congress afford one or two notable exceptions. Foremost among these exceptions stands Dr. Karup's paper on a New Mechanical Method of Graduation—a paper exhibiting remarkable analytical power, and affording incidentally instructive examples of the use of finite differences in interpolation and summation. Of the two established methods of obtaining a mechanical graduation formula—Woolhouse's, based on interpolation, and Higham's, based on the combination of summation in such a way as to obtain a resulting formula correct to any required order of differences—Dr. Karup follows the former. The general principles underlying Higham's method—and, it may be added, its indeterminate and consequently unsatisfactory character—have been clearly set forth by Mr. G. F. Hardy in his note in vol. xxxii of the *Journal*. Woolhouse's method rests upon a different—and, in some respects, more satisfactory—basis. Dr. Karup maintains that Woolhouse's principle has a good theoretical foundation, inasmuch as the application of the theory of errors to the five interpolated values of the function to be graduated gives the same result as that obtained by Woolhouse's process of taking the mean, and he holds that “the irregularities which remain after the “use of Woolhouse's method . . . arise through Woolhouse “having gone no farther than second central differences.” For his new method, however, which he submits as “satisfying all the demands made on a good system of graduation”, Dr. Karup is not content with a single application of an improved Woolhouse formula. His process, briefly described, consists of (1) a preliminary graduation by a simple “rationally-constructed formula”, such as Higham's 17-term summation formula; (2) an adjustment of the resulting values of  $q_x$  by means of an average correction determined, in a special manner, by a comparison of the actual and estimated deaths; (3) a final graduation of  $\log q$  by a new formula, constructed by a method similar to Woolhouse's, but converted, for convenience, into a 19-term summation formula. The new formula differs from Woolhouse's (which, it will be remembered, may be expressed as a 15-term summation formula) owing to the employment of a new third-difference interpolation formula in place of the ordinary central-difference formula, and the conversion of the resulting mean into summation terms affords an opportunity for an exceedingly interesting analysis, in the course of which Dr. Karup demonstrates a general method of converting any such formula as his own or Woolhouse's into a summation formula. As an illustration of his new method, Dr. Karup gives a graduation of the  $H^{M(5)}$  Table, and, comparing it with Dr. Sprague's graphic graduation, he claims that it gives at least as smooth a curve and conforms more exactly to the observed facts. The elegance of Dr. Karup's paper is unquestionable, and it is possible that his refinements upon Woolhouse's method may give a certain amount of fresh vitality to these mechanical methods of graduation, but it may be questioned whether he has fully made out the claim of his method to supersede either the graphic method or



the methods based on the assumption of an algebraical law. A method which rests upon the assumption that "the interval of five years would appear to be the most suitable one that can be chosen, since the calculations with other intervals are inconvenient, or lead to an unsatisfactory graduation", can hardly lay claim to a monopoly in the way of a scientific foundation; and the question as to the relative merits of this or any other mechanical method and the graphic or algebraical methods is not, therefore, one that can be disposed of by an appeal to principle. Dr. Karup approves of the graphic method for a limited experience, but he is of opinion that "the time when it will be sought to graduate the experience of life assurance offices by means of an analytical formula, such as the Gompertz-Makeham, is well-nigh past", and that where the materials are plentiful the preference should be given to a mechanical method. But this view will hardly be generally accepted. A table graduated by an analytical method possesses such important advantages in connection with the calculation of contingent benefits, that it seems eminently desirable that every important table should, if practicable without a serious departure from the observed facts, be adjusted by a method of that nature; while for tables which are not likely to be used for intricate calculations, either the graphic method or some mechanical method of a less complex character than Dr. Karup's would appear sufficiently suitable.

Another paper dealing with a subject of some technical interest is M. Landré's, on the Maximum Amount which may be accepted on a single risk. The subject has not been brought before the Institute of Actuaries since the reading of Dr. Sprague's well-known paper in 1866—perhaps because the practical considerations advanced in that paper have seemed to British actuaries to sum up all that can be usefully said on the subject—but its theoretical aspects have attracted some attention both in France and the United States. M. Landré briefly reviews the investigations of M. Laurent, Mr. Clayton C. Hall, and other writers, and propounds a theory of his own, based upon the principle that a new assurance ought not to increase the *risque relatif*—that is, apparently, the ratio to the expected death-strain of the average deviation therefrom. An arithmetical example of the application of the theory would have been of some interest. It seems not unlikely that the method would bring out a much smaller limit than is usually accepted, but it is not clear that the principle upon which it rests is one that should command assent; it is a secondary, but, from a practical point of view, a not unimportant, consideration that it would be extremely difficult to apply the method owing to the very complicated calculations which it would entail.

The remaining papers in the "miscellaneous" group submitted on the first day of the Congress are comparatively easy reading. In a note on the calculation of surrender-values M. de Savitch suggests the adoption of the formula

$$k \left( V - c \frac{a_{x+n}}{a_x} \right) + (1-k) \left( V' - c \frac{a'_{x+n}}{a'_x} \right),$$

where  $V$  is the ordinary 4 per-cent policy-value,  $c$  is a capitalized loading constant (representing the initial and other expenses with which the assured may equitably be charged on withdrawal), the dashes denote that the affected functions have been calculated by a table suitable to annuitants or other select lives, and  $k$  is a proper fraction. Two tables are given, exhibiting the results brought out by the formula on the basis of German and French standard mortality tables,  $c$  being taken as 5 per cent. and  $k$  as  $\frac{2}{3}$ ,  $\frac{3}{4}$  or  $\frac{4}{5}$ . For a policy for 1,000 effected at age 30 the formula (on the basis of the German table) gives values of 25.13 and 33.24 (according as  $k$  is taken as  $\frac{2}{3}$  or  $\frac{4}{5}$ ) after five years, as compared with a full reserve of 58.96, and 411.23 and 420.69 after 30 years, as compared with the full reserve of 442.90. The method could, of course, be made to bring out suitable values for any company by a suitable selection of the constants ( $k$  might, perhaps, be reasonably taken as 0), but as these constants are practically arbitrary, it can hardly be said to possess any special recommendations.

The two following contributions—Mr. J. J. M'Lauchlan's Note on the Mortality in the British Navy and Army, and Mr. D. Carment's paper on "The Rates of Mortality in Australia and New Zealand"—are of the class which gives to the volume its special character of a mine of information. Mr. Carment's paper, moreover, will be found of general interest—apart from any special purpose for which the statistical particulars which it affords may be required—for it presents, in the space of a few pages, a well-arranged and succinct review of the various investigations that have been made into Australasian mortality and of their principal features. In connection with the two investigations of the Australian Mutual Provident, Mr. Carment mentions that a third investigation, covering the first 50 years of the Society's experience, is now in progress. Up to the present time the  $H^M$  Table has been employed in the Society's valuations, and some comparisons which Mr. Carment gives between the policy-values and those based on the Society's experience indicate that the  $H^M$  Valuation is on the safe side.

The next paper is M. Hankar's "Life Assurance by the Caisse Générale d'Epargne et de Retraite"—an account of the combined life assurance and building society operations of the Belgian Government Savings Bank—and then come the two concluding papers on the first day's programme—"The Limitations of the System of Net Valuations," by Mr. W. S. Nichols, and "The Influence on the Prosperity of Life Office, of Valuations, taking account of Expenses of Management", by Mr. E. W. Scott. Both writers criticize the system of net valuations, but the standpoint of the American actuary is quite different from that of the Dutch manager. Mr. Nichols, in his very lucid and able paper, maintains that "a net valuation can never, of itself, be a complete test of solvency", or "determine the surplus which a company may divide", or "establish the equities of the members, either as a body or individually", or "measure the comparative strength or the sound business management of the companies", but, when all is said, he has clearly no intention of entirely abandoning the faith in which the present generation of

American actuaries has been brought up; the practical points of his paper are that a net valuation is not and ought not to be imposed as a test of solvency, and that its limitations, as well as its uses, should be recognized by the actuary, but it does not appear that Mr. Nichols would propose to discard the net valuation in the case of an ordinary profit-dividing company. Mr. Scott, on the other hand, apparently regards the net premium reserve as an anachronism totally inapplicable to modern conditions and entirely subversive of progressive management. It may be assumed that the majority of actuaries will share the views of Mr. Nichols rather than those of Mr. Scott.

The second day's session of the Congress was devoted to the first of the set subjects selected by the Organizing Committee for special consideration—the subject of “Legislation in relation to Life Assurance, namely, the general principles of the laws which regulate Life Assurance contracts, and the constitution of Assurance Companies.” The majority of the contributors appear to have interpreted the reference as a requisition for a descriptive account of the life assurance laws of the countries which they severally represented. Thus, Mr. R. Teece, in the opening paragraph of his paper on “Life Assurance Legislation in Australasia”, expressly states that his purpose is not so much to enter into a critical analysis of the various colonial enactments as to “fill the position of their ‘historian’”, and the other writers on the subject—with the exception of MM. Adan and Le Jeune, whose papers take a wider range—have dealt in a similar way with the Life Assurance Legislation of New Zealand, Cape Colony, France, Germany, Holland, Russia, Spain, Switzerland, and the United Kingdom. The legal section of the Transactions presents, therefore, a practically complete synopsis of the laws affecting the business of life assurance in the principal Continental Countries and the British Empire, and, although this may not be precisely what the reference was designed to secure, it undoubtedly constitutes a valuable addition to actuarial literature, and is probably more useful than a collection of dissertations on general principles. It is only to be regretted that the section does not include a paper on life assurance legislation in the States or Canada, for, in the absence of a contribution from one of these countries, the system of State supervision remains unrepresented except by the speeches delivered, in the course of the debate, by the late Mr. W. D. Whiting and Mr. Emory McClintock. In this country the question of life assurance legislation is not a burning one, for both the public and the companies are fairly satisfied with the existing law based on the broad principles of freedom and publicity; it is possible that the Life Assurance Companies Acts might be advantageously subjected to some slight amendment, with a view to securing increased publicity, or a fuller measure of reasonable freedom, and, it is possible, again, that some ideas—in regard, for instance, to the registration of assignments—might be usefully borrowed from the statute-books of the Australasian Colonies, but these matters do not press, and many actuaries, no doubt, hold with Dr. Sprague, that “no further legislation is required

in this country", and that "the happy medium has been reached." In the Australasian Colonies individually (except in New South Wales, which has only legislated on the questions of protection against creditors, lost policies, and the rights of married women, and in Queensland, whose legislation, according to Mr. Teece, is a "mere travesty"), a similarly satisfactory state of affairs prevails, and all that is wanted is the substitution of a single Federal Code for the separate codes of the various colonies. On the Continent, however, the case is entirely different. At the date of the Congress none of the Continental Countries, included in the list given above, had any complete scheme of special life assurance legislation—the contract of life assurance being governed, as a rule, by the provisions of the Civil Code, while the status of the Companies and their relations to the State were regulated by the general laws affecting ordinary trading institutions. This state of things, however, is not likely to continue—in fact, draft life assurance laws were actually under consideration by the German and Swiss Governments, when Dr. Samwer and Dr. Ceresole submitted their papers to the Congress, and in Holland the question of life assurance legislation has been pending ever since 1880, when the Royal Decrees by which life assurances business had previously been regulated were declared by the High Court to possess no legal sanction. Hence the subject of life assurance legislation very closely concerns Continental actuaries, for the future of the life assurance companies may be materially affected by the lines upon which the enactments regulating their relation to the State are drawn. Broadly speaking, the issue lies between the principles of State supervision on the one hand, and freedom and publicity on the other. Actuarial opinion on the Continent—to judge from the papers of M. Blankenberg, M. Le Jeune and other writers—is almost unanimously in favour of the latter principle, but it has considerable obstacles to contend with, as may be gathered from the history, as related by M. Blankenberg, of the strait-waistcoat Bill drafted by the last Dutch Royal Commission in 1897. The experience of the United Kingdom, the Australian Colonies, and New Zealand, as recorded in the *Transactions*, ought to prove of material assistance to Continental advocates of the principles of freedom and publicity. Mr. J. H. Richardson's detailed account of the working of the system in the New Zealand Government Insurance Department should be specially useful. It may be noted that Continental Legislation is of importance to British companies transacting continental business, as well as to continental life offices, so that its development—so far, at any rate, as it affects foreign companies—is a matter of some concern to actuaries in this country.

The three subjects of Friendly Societies, Workmen's Compensation, and Old Age Pensions, were set down for separate consideration on the last three days of the Congress, and the papers and discussions relating to them are published in three separate sections in the *Transactions*. The subjects, however, to some extent overlap. In Germany, for example, the State systems of Sickness Assurance, Accident Assurance, and Infirmary and Old Age Assurance are mutually complementary; in France many of the "approved"



Friendly Societies (corresponding approximately to registered Societies in this country) have Pension Funds, upon which, if deposited with the Caisse des Dépôts et Consignation, the State guarantees interest at the high rate of  $4\frac{1}{2}$  per-cent, and in the United Kingdom the sick pay of the Friendly Societies practically merges into a pension at the older ages. It will be convenient, therefore, to adopt a geographical rather than a topical classification as the basis of a brief review of the papers submitted to the Congress on the three subjects under consideration. Belgium, France, Germany and Spain are represented in the Transactions by papers on all three subjects, the United Kingdom and Cape Colony by papers on Friendly Societies and Workmen's Compensation, Russia and Italy by papers on Workmen's Compensation and Old Age Pensions, Holland and New Zealand by papers on the subject of Friendly Societies only, and, finally, Austria by a single paper on Workmen's Compensation. The German system, which, as the only attempt that has yet been made to completely solve the various problems connected with Workmen's Assurance, possesses special importance for the student, is described in a paper by Herr Unger. The series of laws by which the existing scheme of sickness, accident, and old age assurance was established is estimated to apply to between 18,000,000 and 19,000,000 assured persons—being upwards of two-thirds of the wage-earning population of the German Empire and more than one-third of the total population. The assurance against sickness is provided by a variety of institutions, including local and trade organizations of old standing and the municipal funds specially constituted for the purposes of the Sickness Assurance Law, under the general control of the Imperial Assurance Department; Accident Assurance by Trade Associations of Employers under similar control; and infirmity and old age assurance by State District assurance offices. Herr Unger, who writes from the point of view of a firm believer in State assurance, claims that the German system has not operated anti-economically—in proof of which he adduces the fact that the ratio of the number of depositors on the books of the Prussian Savings Banks to the total population, and the average amount of each deposit account, have increased since the passing of the insurance laws—that it will eventually materially relieve the Poor Law Unions (although the relief in this respect has not as yet been marked), that it has led to important improvements in sanitary matters and in the treatment of accidental injuries, that while it has been accompanied by an apparent increase in the total number of accidents (owing to the fact of all sorts of trifling mishaps being reported), it has had the effect of reducing the number of *serious* accidents—as a result presumably of the more stringent preventive regulations imposed by the State—and, finally, that it will redound “to the benefit of internal peace, and the welfare of the German Empire, as well as to the glory of the founder of German Workman's Assurance, the late Emperor William I.” The fulfilment of the concluding prophecy must depend to some extent upon whether the system proves financially sound or not, and as to this there seems room for some reasonable doubt. The sickness scheme is not likely



to give rise to any serious difficulty, for as it embraces practically the whole of the wage-earners, and stops at the point at which the infirmity and old age assurance begins, the assessment plan may answer well enough. But the case is different with the other two branches of assurance. Both the accident and the infirmity and old age schemes entail an increasing liability, and it is a question whether this feature has been adequately provided for. For the infirmity and old age assurances the contributions have been fixed for a period of 10 years on a basis which is virtually a compromise between the level premium system and the assessment system—the Government having originally desired to adopt the former while the employers are strongly in favour of the latter. As regards accident assurance, a few of the trade associations have adopted the plan of raising each year a sufficient sum to cover the estimated present value of the benefits payable in consequence of the year's accidents, but the more usual plan is to raise by assessment the amount required to meet the actual outgo of the year, together with a certain prescribed contribution to a reserve fund; this contribution is fixed by scale, as a percentage of the actual outgo, beginning at 300 per-cent for the first year and gradually declining to 10 per-cent for the eleventh year, after which the interest of the reserve fund may be used for current claims, provided the fund has reached an amount equal to twice the annual outgo. It is possible that the accident reserve-funds, although more or less empirically arrived at, may prove sufficient to obviate the necessity for any material increase in the assessments in future years, but at any rate, as regards the infirmity and old age assurances, it appears that the effect of the scheme is to throw upon the next generation part of the cost of the pensions which are being assured to the present generation, and it remains to be seen whether the obligation can be met without economic disturbance. Herr Unger quotes an official report as stating that “the experience gained during the first five “years in connection with the application of the law” (*i.e.*, the Infirmity and Old Age Assurance Law) “has shown that the “preliminary estimates laid down at the time of the promulgation “of the law, notwithstanding the partial defects in the principles of “the calculations, were sufficiently correct and have not been “exceeded.” But this apparently amounts to nothing more than a certificate of the approximate reliability of the data upon which the contributions were based; it cannot be construed into an endorsement of the semi-assessment plan adopted in the calculation of the contributions. It may be noted, moreover, that in the case of two of the Assurance Institutions—those of East Prussia and Lower Bavaria—the contributions have proved insufficient to form even the partial reserve contemplated by the scheme. This is not economically of any great importance if it is due, as Herr Unger suggests, to the migration of the younger workmen from the districts in question (which are chiefly agricultural) to industrial districts, for in that case the disadvantage to East Prussia and Lower Bavaria would be accompanied by a corresponding advantage to some other district or districts, and the difficulty could be met by combining the separate

district funds into a single Imperial fund; but it is indicative of the sort of problems which may arise under the scheme.

The Austrian workmen's compensation scheme resembles the German in its imperial and compulsory character, and also in the fact that the compensation to the workman in case of incapacitation, or to his family in case of death, takes the form of an annual allowance, reckoned as a percentage on the wages, instead of a single cash payment. But it differs from the German scheme in the matters of organization and finance. Its administration is on a territorial basis, trade associations (of which a railway association is at present the sole representative) being permitted only in cases where they would not adversely affect the business of one or more of the seven territorial institutions. As regards finance, the feature of the Austrian scheme is that the contributions (which are subject to revision every five years) are estimated to cover the entire liabilities, immediate and future, incurred as the result of the year's accidents; the plan is similar to that adopted by the small minority of German trade associations, and seems preferable to the more usual German plan of meeting current claims by assessment and creating an arbitrary reserve, but the contributions may require a good deal of revision owing to the somewhat hypothetical character of the data and assumptions employed in valuing the complicated benefits provided by the scheme. An objection which is often urged against schemes which entail the creation of large reserves is, that they may have an unfavourable effect upon the yield on eligible securities, but Herr Kögler expresses the opinion that this will not be the case with the Austrian scheme, inasmuch as the reserve funds will be created very gradually, and will be largely employed for industrial objects, such as the erection of workmen's dwellings.

The most satisfactory feature disclosed by the papers relating to Friendly Societies, Workmen's Compensation, and Old Age Pensions in Belgium is the remarkable development of the business of the Caisse Générale de Retraite. This institution, which is guaranteed by the State, grants deferred annuities, for amounts not exceeding 1,200 francs per annum, to be entered upon at any age from 50 to 65, and the number of such annuities on its books had increased from under 5,000 in 1888 to upwards of 170,000 in 1897; the contributions, which may be either on the returnable or on the non-returnable scale, are based on Quetelet's Table at 3 per-cent interest with 3 per-cent loading. It appears that, in case of permanent incapacitation by accident, a member of at least five years' standing is entitled to enter immediately into receipt of his annuity, to an extent limited to 360 francs per annum; but, as this benefit is not allowed for in the calculation of the premium, it is presumably intended to be met by State subsidies. M. Lepreux anticipates that the business of the Caisse de Retraite will continue to expand rapidly, as it is actively supported by the great body of employers, by many of the Friendly Societies, and by the primary schools, and he considers that the voluntary provision thus made by the working classes, for their old age, taken in conjunction with the various Staff Pension Funds, constitutes a sufficient solution of the Old Age

Pension problem; it would be interesting, however, to know to what extent the members of the Caisse are drawn from the lower strata of the wage-earning classes. Friendly Society business has been fairly extensively developed in Belgium, but its financial basis appears to be very far from satisfactory. At the end of 1895 there were in existence 752 registered societies with 97,591 benefit members, and about 176 unregistered societies with about 35,732 members. Registration confers certain privileges similar to those enjoyed by registered societies in the United Kingdom, but it does not entail any obligations in regard to valuation. M. Duboisdenghien states that the liabilities of the societies—whether registered or unregistered—“have never been subjected to any valuation whatever”, but he gives the results of valuations which he has made, for the purposes of the Congress, in the case of three typical societies, and in each case a very large deficiency (relatively to the fund) is brought out. The chief obstacle to reform is that the desirability of creating an actuarial reserve is practically unrecognized outside actuarial circles. In regard to Workmen's Compensation, the Belgian actuaries appear to have been more successful in influencing official opinion. A draft Bill, drawn more or less on the lines of the Austrian scheme, was dropped, as the result of actuarial criticism, and a new Bill, presenting some similarity to the Workmen's Compensation Act of the United Kingdom, was subsequently introduced.

In France, the general position of affairs is somewhat similar to that which obtains in the United Kingdom. Friendly societies are regulated by the law of 1 April 1898, and are divided into *Free Societies*—which have practically unrestricted liberty of action—and *Approved Societies*, which are required to submit their rules for approval, and to charge adequate premiums, and are entitled to deposit their funds at  $4\frac{1}{2}$  per-cent with the Caisse des Dépôts et Consignation, and to receive a share “in the endowments, allowances and special subscriptions set aside for the encouragement of the purchase of old age pensions, for the supplementing of small pensions, and, finally, for helping them when, through epidemics or any other cause, they find themselves temporarily unable to fulfil their engagements.” Old age pension business appears to form an important part of the operations of the French Friendly Societies. There is also a National Old Age Pension Fund, which grants deferred annuities on much the same basis as the Belgian Caisse Générale de Retraite, and is to some extent subsidized by the State. This institution, and the special staff funds belonging to the railways and other organizations, do not, however, go far towards the solution of the general problem, and in France, as in England, numerous national old age pension schemes—some based on taxation, others on compulsory contributions—have been proposed. An interesting account of these schemes is given in M. Duplaix's papers. Perhaps the most remarkable proposal is that of M. Laisant, who suggests that the necessary fund to provide aged Frenchmen with a minimum pension of 500 francs a year should be raised by taxing employers and foreign workmen, and by imposing duties on necessary articles of food. Compensation for accidents is insured to “workmen and

notice of readers of the *Journal*. In the first place, it marks the beginning of the end of the Herculean labours entrusted, several years ago, to the Joint Committee of the Institute and the Faculty of Actuaries. The results of these labours have been eagerly awaited, in the hope that they may help to settle many questions hitherto in doubt, and general approval will be extended to the action of the Committee in publishing what may be called the first section of their Report at the earliest possible moment. But special interest attaches to the Annuity Experience. Mr. King's article "On the Rate of Mortality amongst the Female Nominees of the General Annuity Trust Fund during the period from 1 January 1869 to 31 December 1895" (*J.I.A.*, xxxiii, 262), confirmed, in a most striking way, what was becoming a prevalent belief—that the Government Annuitants' Experience, 1883, was no longer a proper standard by which to estimate the mortality of annuitants at the present time—that, in fact, the vitality of annuitants now is really greater than that of the body of lives on whose experience Mr. Finlaison's Tables were based. As the volume of annuity business has increased enormously in recent years, and as the fall in the rate of interest has been so rapid, some anxiety has been felt as to whether adequate rates have been charged. To a certain extent, the Tables now published are reassuring. No definite conclusions can, of course, be based on the New Experience until the adjusted results and the monetary tables are published. So far, however, as the original unadjusted data show, it appears that the "Select" 3 per-cent annuity-value by the new tables exceeds that by the Government Annuitants' Experience, 1883, by an amount corresponding, as a rule, to a difference of not so much as one year in the age. Thus we have the following table:

*Select Annuity-Values, at 3 per-cent.*

Age	MALES			FEMALES			Age
	New Experience	Difference	Government Experience, 1883	New Experience	Difference	Government Experience, 1883	
40	16·360	−·016	16·376	18·184	+·004	18·180	40
45	14·600	−·552	15·152	16·993	·173	16·820	45
50	13·867	+·054	13·813	15·585	·314	15·271	50
55	12·667	+·357	12·310	13·971	·364	13·607	55
60	10·862	+·261	10·601	12·158	·467	11·791	60
65	9·029	+·127	8·902	10·281	·372	9·909	65
70	7·313	+·014	7·299	8·471	·471	8·000	70
75	6·095	+·286	5·809	6·644	·277	6·367	75
80	4·530	−·023	4·553	4·941	·004	4·937	80

The differences run very irregularly, but it will be noticed that (disregarding the negative figure −·552 at age 45) the largest difference is ·471 at age 70 in the Table for Females, being



5·89 per-cent of the Government annuity-value. Here the annuity-values by the New Experience and by the Government Experience, 1883, are respectively 8·471 and 8·000; and it will be found that in the latter table 8·471 corresponds to age  $68\frac{3}{4}$  nearly. Very similar results are indicated by the Tables which show the Curtate Expectations of Life by the New Experience and the Government Annuitants' Experience. What is very clearly brought out by these comparisons is that it is among *female* annuitants chiefly that the vitality has been in the past under-estimated, and this is, from the Life Office point of view, particularly unfortunate. However, it may be as well to defer further consideration of the Experience until the adjusted figures and monetary tables appear. For the present it will suffice if we give a very short account of what the volume now published contains.

The data collected by the Joint Committee are divided into "Old" and "New", the former being the contracts effected before 1 January 1863 and brought under observation at their anniversaries in the year 1863, and the latter being annuities which were granted between 1 January 1863 and 31 December 1892. Select Tables are given for each age at purchase, and each year elapsed since purchase, showing the numbers entered, existing, died, and exposed to risk, in respect of Old, New, and Combined Old and New Annuities, separately. These Tables occupy about four-fifths of the volume—the "Males" section requiring 74 pages and the "Females" section 92. Even the most cursory glance at the Tables reveals points that will be novel to most people. Thus it seems that annuities are sometimes purchased on the lives even of infants. One annuity, for example, was purchased on a male child aged 1; the contract had been 49 years in force when it came under observation, and it was still in force 30 years later on its anniversary in the year 1893, not a very profitable contract to the office! Four annuities, too, seem to have been purchased on the lives of female infants aged "0", and the purchasers again were fortunate, for two were still in force at ages 76 and 78 at the close of the observations, while the other two did not cease by death till after 73 and 74 respectively.

Then follow Tables showing the unadjusted probabilities of dying in each of the ten years following purchase; (*a*) arranged according to Age at Purchase; (*b*) arranged according to Age Attained. In each case a Table is added, showing the Unadjusted Probabilities deduced from the data for quinquennial groups of ages. This set of Tables, it should be noticed, is based on the Combined Old and New Annuities.

The only other Select Tables (besides the Tables of Annuity-Values at the Date of Purchase, at 3 per-cent, of which mention has already been made) are Tables giving the Rates of Mortality and the Curtate Expectation of Life. Here the selection is traced for 4 years, and the data are the Combined Old and New Annuities. The corresponding Rates of Mortality and Curtate Expectations in the Government Annuity Experience 1883 are added, for purposes of more easy comparison.

In addition to the Select Tables, sets of Aggregate Tables are



published. The first set give the numbers entered, existing, died, and exposed to risk, as well as the functions  $l_x$ ,  $d_x$ ,  $p_x$ ,  $q_x$ , and  $e_x$ , for Old Annuities, New Annuities, and for Combined Old and New Annuities. These are based upon the whole Experience, and there are accordingly added, for the Combined Annuities only, similar Aggregate Tables (a) excluding the experience of the first 5 years following purchase, (b) excluding the experience of the first 10 years following purchase. Corresponding, too, to the Select Tables, Aggregate Tables giving the Rate of Mortality and the Curtate Expectation of Life are given, and again an opportunity is afforded for a comparison with the Government Annuitants' Experience, 1883.

Finally, we should call attention to the Schedule of Withdrawals, excluded from the Annuity Experience, (on pp. 204-5), and to the Erratum in the note on p. 214. Here line 5 ought to read:

“where  $tp_{[58] \dots [62]}$  is the continued product of the function

$$\left\{ 1 - \frac{\theta_{[58]+n} + \theta_{[59]+n} + \theta_{[60]+n} + \theta_{[61]+n} + \theta_{[62]+n}}{E_{[58]+n} + E_{[59]+n} + E_{[60]+n} + E_{[61]+n} + E_{[62]+n}} \right\}$$

“for values of  $n$  ranging from 0 to  $(t-1)$ .”

## CORRESPONDENCE.

### THE LIFE ASSURANCE COMPANIES ACTS, 1870 to 1872.

*To the Editor of the Journal of the Institute of Actuaries.*

SIR,—By the provisions of the Statute Law Revision (No. 2) Act, 1893 (56 and 57 Viet., ch. 54), a large number of enactments, specified in a lengthy Schedule appended to the Act, have been repealed in whole or in part. It is not, I think, generally known that, amongst the enactments of which portions are so repealed by the Act of 1893, are included the Life Assurance Companies Acts of 1870 and 1872.

The preamble of the Act of 1893 recites as follows:

“Whereas it is expedient that certain enactments which may be regarded as spent, or have ceased to be in force otherwise than by express specific repeal by Parliament, or have, by lapse of time or otherwise become unnecessary, should be expressly and specifically repealed”, &c., &c.

Section 1 of the Act, after enacting the repeal, in whole or in

part, of the statutes specified in the Schedule to the Act, provides (*inter alia*) that—

“The repeal of any words or expressions of enactment described in the said schedule shall not affect the binding force, operation, or construction of any statute, or of any part of a statute, whether as respects the past or future ”

\* \* \* \* \*

“and this Act shall not affect the validity, invalidity, effect, or consequences of anything already done or suffered,—or any existing status or capacity,—or any right, title, obligation, or liability, already acquired, accrued, or incurred, or any remedy or proceeding in respect thereof,—or any release or discharge of or from any debt, penalty, obligation, liability, claim, or demand,—or any indemnity,—or the proof of any past act or thing ;”

\* \* \* \* \*

It would thus appear that the intention of the Act was to remove unnecessary words of recital or enactment, without thereby affecting the existing statute Law.

The portions of the Life Assurance Companies Acts dealt with are indicated in the extracts below, within square brackets :

#### LIFE ASSURANCE COMPANIES ACT, 1870.

(33 & 34 Vict., ch. 61.)

[Be it enacted by the Queen’s most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :]

\* \* \* \* \*

5. [From and after the passing of this Act] every company shall, at the expiration of each financial year of such company, prepare a statement of its revenue account for such year, and of its balance sheet at the close of such year, in the forms respectively contained in the first and second schedules to this Act.

\* \* \* \* \*

#### LIFE ASSURANCE COMPANIES ACT, 1872.

(35 & 36 Vict., ch. 41.)

[Be it enacted by the Queen’s most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal,

and Commons, in this present Parliament assembled, and by the authority of the same, as follows :

1. Whereas by the provisions of the “Life Assurance Companies Acts, 1870 and 1871”, a life assurance company is required to pay a sum of money into the Court of Chancery by way of deposit, and the certificate of incorporation of such company is not to be issued unless such deposit has been made, and such deposit is to be returned to the company as soon as its life assurance fund amounts to the sum therein mentioned ; and doubts have arisen as to the construction of the said provisions, and it is expedient to remove such doubts ; be it therefore enacted as follows :]

The said deposit may be made, &c., &c.

\* \* \* \* \*

2. Whereas by Section four of the Life Assurance Companies Act, 1870, it is enacted that “In the case of a company established after “the passing of this Act, transacting other business besides that of “life assurance, a separate account shall be kept of all receipts in “respect of the life assurance and annuity contracts of the company, “and the said receipts shall be carried to and form a separate fund, “to be called the life assurance fund of the company, and such fund “shall be as absolutely the security of the life policy and annuity “holders as though it belonged to a company carrying on no other “business than that of life assurance, and shall not be liable for any “contracts of the company for which it would not have been liable “had the business of the company been only that of life assurance ;” [and further provisions were made by the same section, with respect to the application of the above recited part of the said section to existing companies, and doubts have arisen with respect to the construction of the said provisions, and it is expedient to remove such doubts ;] be it therefore enacted,

That the portion of Section four of the Life Assurance Companies Act, 1870, above recited shall apply to every Company established before the passing of that Act, provided that the Life Assurance Companies Act, 1870, and this Act shall not diminish the liability of the life assurance fund for any contracts of the company entered into before the passing of the Life Assurance Companies Act, 1870.

\* \* \* \* \*

It will be remembered that the “further provisions” (referred to in the above clause within square brackets) of section 4 of the Act of 1870, run as follows :

. . . and in respect to all existing companies, the exemption of the life assurance fund from liability for other obligations than to its life policyholders shall have reference only to the contracts entered into after the passing of this Act, unless by the constitution of the company such exemption already exists: Provided always, that this section shall not apply to any contracts made by any existing company by the terms of whose deed of settlement the whole of the profits of all the business are paid exclusively to the life policyholders, and on the face of which contracts the liability of the assured distinctly appears.

\* \* \* \* \*

It will be seen that the words and clauses omitted from the Act of 1870 are unimportant.

As regards the words deleted from the opening sections of the Act of 1872, it will be remarked that the Act, as modified, now commences with the words "The *said* deposit . . . ."

Section 2 of the 1872 Act, taken with section 4 of the 1870 Act, has often been the subject of discussion (v. *J.L.A.*, xvi, 3; xxix, 501; xxxiv, 583, 584), and the interpretation of these sections does not seem to have been made any clearer by the omission from the former section of the words of recital printed above in square brackets, which perhaps threw a little light upon the intentions of the framers of this section.

Whether the omission of these words from section 2 of the Act of 1872 can affect the force and construction of that section, and of section 4 of the Act of 1870, must be a question for the lawyers; but we may, perhaps, conclude (as I have said) that it was certainly not the intention of the framers of the Act of 1893 so to affect the law. Upon the other hand, the words omitted would hardly come under the qualifying provisions of section 1 of the Act of 1893 (quoted above) as "words or expressions of enactment", being rather words or expressions of *recital*.

I am, Sir,

Yours obediently,

THOMAS G. ACKLAND.

15 December 1899.

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## STAMPS ON DEBENTURES.

*To the Editor of the Journal of the Institute of Actuaries.*

SIR,—As many students are doubtless constantly referring to Mr. Barrand's valuable paper on Debentures in the 34th volume of the *Journal*, it may not be out of place to call attention to the decision of the Court of Appeal, on the 6th instant, as to the stamping of debentures.

Mr. Barrand referred in his paper (*J.I.A.*, xxxiv, 431) to the case of Rowell & Son, Limited *v.* The Commissioners of Inland Revenue (L. R. 1897, 2 Q. B. 194), in which it was decided that a debenture containing an obligation on the issuer to redeem at a premium should be stamped, not merely on its par value, but also on the premium; and he further mentioned that the decision applied only to debentures redeemable at a premium in any event, and not to those merely containing an option to redeem at a premium. In the discussion on the paper, I pointed out that the case of *The Knight's Deep Limited v. The Commissioners of Inland Revenue* (L. R. 1899, 1 Q. B. 345, 79 L. T. Rep. 704), decided the week previous to the reading of the paper, was in conflict with the latter statement. The debentures in that case were redeemable at par by annual drawings commencing in 1902, but they bore a condition enabling the issuing company to redeem them, at any time after July 1900, at a premium, on giving six months' notice and under certain other conditions. The Divisional Court held that, notwithstanding the fact that the premium was not payable in any event, the duty should be assessed on the par value plus the premium, and on the 30 March last, the Inland Revenue authorities issued a circular calling attention to the decision.

The Company, however, appealed, and the Appeal Court have now unanimously allowed the appeal, holding that the duty should be charged on the par value of the debentures only (*Times*, 7 December 1899).

Unless, therefore, the decision of the Court of Appeal should be reversed by the House of Lords, it would appear that if a debenture is only redeemable at a premium under certain conditions at the option of the issuing company, and is redeemable at par if the company do not exercise such option, the premium need not be taken into account for the purpose of assessing the stamp duty.

I am, Sir,

Your obedient Servant,

J. E. FAULKS.

15 December 1899.

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## THE INSTITUTE OF ACTUARIES.

## THE LIBRARY.

ATTENTION is called to the annexed amended Rules for the Regulation of the Library.

No change has been made in the Rules as to the number of books that may be borrowed by a Member, or as to the time for which he may keep them; the only alteration being that a penalty will in future attach to infringement of the Rules. That penalty will be rigidly enforced.

It is not intended in any way to interfere with the convenience of Members, but, on the contrary, to increase it. The imposition of a penalty has been rendered necessary by the thoughtless action of a few Members, who have been accustomed to take out books in great request, and to retain them for an unreasonable time; paying no attention to repeated applications for their return, and thereby depriving to a great extent other Members of the benefits of the Library.

It will be noticed that, as heretofore, when a book is returned by a Member, it may be borrowed by him again, provided it has not been bespoken in the meantime by another Member.

## RULES

FOR THE

## REGULATION OF THE LIBRARY.

1. The Library is open daily, from Ten to Five, from 1st of May to 31st August, and from Ten to Six from 1st October to 30th April, except on Saturdays, when it is open from Ten to Two. It is closed for revision during the month of September.

2. Members of the Institute are permitted to take out Two Books on making application in person, or by letter addressed to the Assistant Secretary; but no Member may keep any work

longer than a Fortnight. If a Book be retained beyond that period, the borrower shall pay a fine of One Shilling per volume for each week, or part of a week, during which it is so retained, and shall not be permitted to obtain another from the Library until the missing Book has been returned and the fine paid. When a Book is returned by a Member, it can be borrowed by him again, provided it has not been bespoken in the meantime by another Member.

3. Scientific Journals and Periodicals are not circulated until the volumes are completed and bound.

4. Cyclopædias and works of reference and certain other volumes are not circulated.

5. Any Member damaging, or losing, a work must pay an amount to be fixed by the Council as the equivalent of the damage or loss sustained.

6. Works taken from the shelves for reference are not to be replaced, but must be laid on the Library table.

7. A list of defaulters shall be submitted monthly at each meeting of the Council.

By Order of the Council.

*November, 1899.*

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## JOURNAL

OF THE

## INSTITUTE OF ACTUARIES.

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*Some Notes on Makeham's Formula for the Force of Mortality.* By H. P. CALDERON, F.I.A.

[Read before the Institute, 18 December 1899.]

## NOTE I.—MODEL TABLES.

THE first object of the present paper is to bring before the members of the Institute some model tables, which I have constructed shewing the force of mortality and the expectations of life based on a single value of  $\log c$ , combined with certain constant values of  $A$  in the formula

$$\text{Colog } p_x = A + Bc^x$$

Finding some time since, in connection with some work then in hand, that many conveniences would result from model tables on Makeham's hypothesis with which to compare the deduced functions of an ungraduated table, I gave some consideration to the most general form in which such a work could best be accomplished, resulting in the Tables, Nos. I, II, III, and IV, which I have the honour to lay before you this evening.

It is to be noted that if we are given the value of a continuous or complete annuity or expectation of life, in the terms of one unit of time, we can obtain the value of the same functions in terms of a different unit of time by simple multiplication or division.

To take a simple illustration—

The value of a continuous annuity of £1 per annum is the same as that of 10s. per half year, or of 1s. 8d. per month, under the same conditions of continuity, and generally the value of £1 per annum paid continuously is that of £ $a$  per  $a$  years (where  $a$  is either fractional or integral), and, if  $a$  represents the value of £1 per annum,  $a^n$  also represents the value of £ $a$  per  $a$  years, and  $\frac{a}{a}$  of £1 per  $a$  years.

In the same way, the force of mortality is the measure of a momentary force stated in terms of its effect, if in continuous operation, upon a constant exposure, over a given unit of time, and the force of itself remains unchanged by any alteration we make in the unit of time, the measure of the force altering in direct ratio of the measure of the unit of time.

These propositions are necessarily true whatever form the formation  $a$ ,  $e$ , and  $\mu$  respectively take, but if, further, we are making use of Makeham's formula,  $\mu_x = A + Bc^x$ , then  $\mu_x$  becomes a continuous function for continuous values of  $x$ , wherein

$$\frac{d}{dx}\mu_x = \beta c^x \text{ where } \beta = B \log_e c.$$

Here, again,  $\frac{d}{dx}\mu_x$  is the measure of the continuous increase in the value of  $\mu_x$  stated in terms of a given unit of time.

If this unit of time be altered from 1 to  $\frac{1}{a}$ , then the number of units become  $xa$ , and

$$\frac{d}{d(xa)}\mu_{(xa)} = \beta \gamma^{xa} = B \gamma^{xa} \log_e c \text{ where } \gamma^a = c$$

$$\frac{d}{dx}\mu_{(xa)} = a \beta \gamma^{xa} = B \gamma^{xa} \frac{a \log_e c}{a} = B \gamma^{xa} \log_e \gamma$$

where  $\gamma$  in lieu of  $c$  now becomes our new unit of measurement of the increment, so that we shall find that if we have the force of mortality given for intervals of one year, in terms of the measure for one year, the same values, when multiplied by  $a$ , supply us with the values of the same force measured in terms of the new unit  $a$ , the series of values so obtained being those applicable respectively to the terms *separated by the new unit of time*  $a$ .

These tables, Nos. I, II, III, IV, as will be seen, are based on a uniform value of  $c$  such that  $\log c = .005$ , and, thereunder,

the force of mortality given is for that unit of time (whatever it may be in terms of a calendar year) for which  $c$  has such given value.

In order, therefore, to obtain the corresponding force of mortality for the period wherein  $\log c' = .005a$  we have merely to multiply our force of mortality given in the table by the term  $a$  in order to get the force *measured in terms of our new unit of time* and to select the terms  $x, x+a, x+2a$  in our table, to find those which, after multiplication by  $a$ , shall represent the series of values equidistant by the unit of our new measure of time.

Similarly, the values of the expectations of life given in the tables, are complete expectations representing the mean after-lifetime in terms of the unit of time for which  $c$  has a value such that  $\log c = .005$ .

To find the expectation of life in terms of the unit of time for which  $c'$  is such that  $\log c' = .005a$  we have merely to divide the expectations in the table by  $a$ , again selecting the values equidistant by  $a$  to give those for consecutive terms of our new unit.

In a word, 7 times the force of mortality as tabulated, selected for every seventh term, will be a series of the force of mortality for a table wherein  $\log c = .035$ , whereas 8 times the force for every eighth value will represent that for  $\log c = .04$ . Similarly, the expectations chosen on the same basis respectively must be divided by 7 or 8 to obtain the expectations for  $\log c = .035$  or  $.04$ .

The same result may be seen by taking formula No. 20 (Woolhouse's), given on p. 477 of the *Text-Book*, where we have, when  $\omega = \infty$

$$\int_0^{\infty} u_x dx = \frac{1}{m} \left( u_0 + \frac{u_1}{m} + \frac{u_2}{m} + \&c. \right) - \frac{1}{2m} u_0 + \frac{1}{12m^2} \frac{du_0}{dx} - \frac{1}{720} \frac{d^3 u_0}{dx^3} + \&c.$$

for writing  $mx = y, m dx = dy, m^3 dx^3 = dy^3$ , we have—

$$\int_0^{\infty} \frac{u_y}{m} dy = \left( u_0 + u_1 + u_2 + \&c. \right) - \frac{1}{2} u_0 + \frac{1}{12} \cdot \frac{du_0}{dy} - \frac{1}{720} \cdot \frac{d^3 u_0}{dy^3} + \&c.$$

the same result as in formula (19), and, since  $u_0, u_1, u_2, \&c.$ , are the same terms as  $u_0 + \frac{u_1}{m}, \frac{u_2}{m}, \&c.$ , the approximation in each

case falls short of the true integral, only in so far as we include a greater or smaller number of the differential coefficients. But if,

further, we write for  $u_0, \&c.$ ,  $\frac{1}{m} u'_0, \&c.$ , the *numerical* values of the functions are then merely dependent upon that which



we attach to the algebraical unit, in this case inversely to the term, so that—

$$\int_0^{\infty} u' \frac{y}{m} dy = \frac{1}{m} \int_0^{\infty} u \frac{y}{m} dy.$$

The basis of the tables is, as I have said,  $\log c = .005$ , but after preparing Tables III and IV on this extended basis for 600 values, I reduced the work to that of the computation of tables really based on  $\log c = .05$  but stated in terms of  $\log c = .005$ , for the sake of uniformity, supplying any corrections to the complete expectations, where found necessary (which was only at the high ages), from the more extended tables. These results are given in Tables Nos. I and II, and are based on values of A (in  $\text{colog } p_x$ ) respectively .0001, .0002, .0003, .0004, .0005 for the term for which  $\log c = .005$ .

To give a practical example—if we wish to find the progressive values of the force of mortality by a table, on Gompertz's hypothesis wherein  $\log c = .038$ , we have only to select a series of values as under from Table No. I.

Say—

$$\mu'_{140} = .0000111$$

$$\mu'_{330} = .0000989$$

$$\mu'_{520} = .0008810$$

$$\mu'_{710} = .007852$$

separated by the lowest multiple of 19 that our table will supply.

Then—since we may choose any term as the commencing term of our series—

$$7.6 \times \mu'_{140} = \text{say } \mu_0 = B$$

$$7.6 \times \mu'_{330} = \mu_{25} = Bc^{25}$$

$$7.6 \times \mu'_{520} = \mu_{50} = Bc^{50}$$

$$7.6 \times \mu'_{710} = \mu_{75} = Bc^{75}$$

whilst from Table No. II we have the corresponding expectations,

$$\bar{e}'_{140} = 553.774 \text{ and } \frac{\bar{e}'_{140}}{7.6} = \bar{e}_0$$

$$\bar{e}'_{330} = 367.038 \text{ and } \frac{\bar{e}'_{330}}{7.6} = \bar{e}_{25}$$

whilst for the higher ages, we may pass to Table No. III and get values differing by smaller intervals.

Of course, we obtain values from Tables Nos. I and II, by taking every tenth value, which will, however, correspond not to

integral ages, but to the fractional ages  $\frac{10}{7.6}$  and its multiples, from which we may interpolate. Should the result of a discussion of this paper prove that the tables are likely to be of real service to a large number of actuaries, it would be possible to extend Tables No. III and IV by inclusion of a larger number of constants of the form A.

In column (3) of these tables are given the values of  $Bc^t$  in such form that on employing the figures tabulated as the force of mortality corresponding to the values of the expectations given in columns (4), (5) and (6), it will be necessary to multiply them by .001, .01 and .1 respectively.

But these values can also be employed to obtain the values of  $\text{colog } p_x$  and  $l_x$

since 
$$\log_{10} l_x = K - \frac{Bc^x}{\log_e c} \cdot \log_{10} e$$

and 
$$\text{colog}_{10} p_x = \frac{B \cdot c^x (c-1)}{\log_e c} \log_{10} e$$

hence we find 
$$\log_{10} \frac{(c-1) \log_{10} e}{\log_e c} = 1.640 \text{ approximately,}$$

and the values of  $\text{colog } p_x$  are to be read off either by deducting 72 from the value of  $t$  or adding 128 and, in the latter case, dividing the result by 10, and then applying the above modifications for the three columns. Similarly,  $\text{colog}_{10} l_x$  considered apart from the constant K is equal to

$$\frac{\log_{10} e}{\log_e c} \mu_x = 1.5863 \mu_x$$

and can be read off as under—

either adding 117 to the value of  $t$  and multiplying by 10,

or deducting 83 from the value of  $10t$  and multiplying by 100,

in each case giving effect to the same modifications as above for the columns. These values are not, however, entirely correct, requiring to be further corrected for the balance of the logarithm, namely, .0013 =  $\log 1.0030$ , so that .003 of the values themselves should be added thereto.

For the values of  $\text{colog } l_x$  corresponding to the constant term in the mortality, a suitable value of  $\log a^x$  requires to be added, as well as a general reduction to any selected radix. I have, therefore, thought it better to leave the  $l_x$  column in this unfinished state, there being such a large number of variable elements in

reducing the values to the most practical special form for which they might be required.

From Tables Nos. III and IV, we shall be able to obtain, in respect of any value of  $\log c$  to three decimal places, expectations for differences of 5 years in age, by simple division, and the figures can be readily cast out by the use of *Cotsworth's Tables*. From Table No. II, further values can be obtained, if required, and by interpolation expectations can be computed for other values of the constant  $A$ .

In the actual construction of the Tables, regard was had to the scope which could be afforded in respect of values lying about  $\log c = .04$ , and extracts from the original calculations are supplied which range from a convenient value for age  $\omega$  of the Table.

#### ON METHODS OF FINDING $\log c$ FROM THE "EXPOSED TO RISK."

At the same time that I have been considering the application of model tables to the requirements of graduation by Makeham's formula, I have been led to consider some scheme by which tentatively we might be able to deduce the value of  $\log c$  in connection with, if not absolutely derived from, the actual numbers exposed to risk and numbers dying, and the following notes are put forward as a contribution rather designed to raise discussion and obtain further light upon the subject, and as an indication of lines either to be adopted and further developed by other students; or, should the processes prove on further trial that the hypothesis is untenable, to be rigidly excluded.

I may say, therefore, in presenting the attempts at graduation, here set out, that although elaborated to illustrate and, if possible, to remove certain difficulties to be met with, I do not necessarily accept as final the results so obtained, putting forward the following methods as those for obtaining one value at least of  $\log c$  with which to compare graduations with values otherwise found.

It will be noticed upon looking at the numbers Exposed to Risk and Deaths, for aggregate tables, that both these numbers rise to a maximum towards the middle of the table, the maximum occurring much later in the case of the Deaths than in the Exposed to Risk, and whilst this is so, in every table like the *Institute Tables* going back in its observations to the issue of the policy on each life, this factor will be still more accentuated when we gather an experience wherein the lives enter not on the first year of assurance, but at some even calendar date.

The application of frequency curves, such as suggested by Professor Karl Pearson in the "Chances of Death," to the terms of a mortality table, seem to have no direct value, as such, for application to the unadjusted data. At the same time, it has occurred to me that as a first approximation, we might attempt to represent both the exposed to risk and deaths by some reciprocal curve of the form

Exposed to Risk

$$= a_0 + a_1b + a_2b^2 + \dots + a_2b^{n-2} + a_1b^{n-1} + a_0b^n$$

and Deaths

$$= a_0 + a_1(bc)^2 + a_2(bc)^2 + \dots + a_2(bc)^{n-2} + a_1(bc)^{n-1} + a_0(bc)^n.$$

Necessarily, the simplest form of such a curve is that of the binomial expansion, and, though we cannot expect very close agreement with the true numbers either of the Exposed to Risk or Deaths, yet the exaggerations in excess or defect will follow closely upon the same lines in each curve.

#### METHOD A.

It will be easy enough in the case of both Exposed and Deaths to find a binomial expression so that the sums and accumulated sums shall be the same as those of the original facts.

Representing the Exposed to Risk by  $E_x$  and the Deaths by  $\theta_x$ , the exposed may now be represented by the terms of the expansion of

$\Sigma E.(a+b)^n$  where  $a+b=1$ , and where  $n+1$  is the number of the different items of Exposed to Risk, so that we have

$$E'_0 \text{ (the new Exposed)} = a^n \Sigma E$$

$$E'_n \text{ (the new Exposed)} = b^n \Sigma E$$

$$E'_x = \frac{n \cdot n-1 \dots n-x+1}{x} \cdot a^{n-x} b^x \Sigma E$$

and the Deaths are represented by the expansion of

$$\Sigma \theta (a+\beta)^n \text{ where } \frac{\beta}{a} = \frac{bc}{a} \text{ and hence, since } a+\beta=1,$$

$$a = \frac{a}{a+bc} \text{ and } \beta = \frac{bc}{a+bc}$$

$$\text{so that } \theta_x = \frac{n \cdot n-1 \dots n-x+1}{x} a^{n-x} \beta^x \Sigma \theta$$

For the second summation in each case (excluding the total from such second summation)

$$\text{we have} \quad \Sigma^2 E = \Sigma x E_x$$

$$\text{and} \quad \Sigma^2 E' = \Sigma x E'_x$$

$$\begin{aligned} \text{whilst } x E'_x &= x \frac{n \cdot n-1 \cdot n-2 \dots n-x+1}{x} a^{n-x} b^x \Sigma E \\ &= nb \cdot \frac{n-1 \cdot n-2 \dots n-x+1}{x-1} a^{n-x} b^{x-1} \Sigma E \end{aligned}$$

$$\begin{aligned} \text{so that } \Sigma^2 E' &= \Sigma \left( \frac{n-1 \cdot n-2 \dots n-x+1}{x-1} a^{n-x} b^{x-1} \right) nb \Sigma E \\ &= nb(a+b)^{n-1} \Sigma E \end{aligned}$$

and since  $a+b=1$  and we are making  $\Sigma^2 E' = \Sigma^2 E$  we have

$$\frac{\Sigma^2 E}{\Sigma E} = nb \dots \dots \dots (1)$$

$$\text{Similarly, for Deaths, we have } \frac{\Sigma^2 \theta}{\Sigma \theta} = n\beta \dots \dots \dots (2)$$

$$\text{and thence we have} \quad \beta = \frac{bc}{a+bc}$$

$$\text{or} \quad c = \frac{a\beta}{b(1-\beta)} = \frac{(1-b)\beta}{b(1-\beta)} \dots \dots \dots (3)$$

The relation of the two hypothetical curves is that of a force of mortality following Gompertz's law. In passing, however, to the actual numbers dying and exposed, whilst the value of  $\log c$  as found was employed, the calculations proceeded upon the basis of finding two constants A and B.

#### METHOD B.

Naturally enough, if we are seeking to graduate by the formula  $A+Bc^x$ , it would seem advisable to represent the Death curve by a formula which gives this additional constant.

In that case we should have for the series of equations to the Deaths:

$$\begin{aligned} \theta_x &= \frac{n \cdot n-1 \dots n-x+1}{x} a^{n-x} b^x (A+Bc^x) \Sigma E \\ &= \frac{n \cdot n-1 \dots n-x+1}{x} a^{n-x} b^x A \Sigma E + \frac{n \cdot n-1 \dots n-x+1}{x} a^{n-x} (bc)^x B \Sigma E \end{aligned}$$





# DIAGRAM NO. I.

## INSTITUTE HEALTHY FEMALES (H<sup>F</sup> TABLE).

— Exposed to Risk, percentage of total Exposed.

Do. Curve  $(a+b)^x$  to represent the above.

— Deaths, percentage of total Deaths.

Do. Curve  $(a+\beta)^x$  to represent the above.

Graduated Table of Expected Deaths, based on curve for which  $\log e = .2101$

$\log e$  was deduced from  $(a+\beta)^x$  and  $(a+b)^x$ .

Grouped Ages (5)

0-5, 10-14, &c., to 95-and.

Total Exposed 148,693

Total Deaths 3,335

13.5

12.0

10.5

18.0

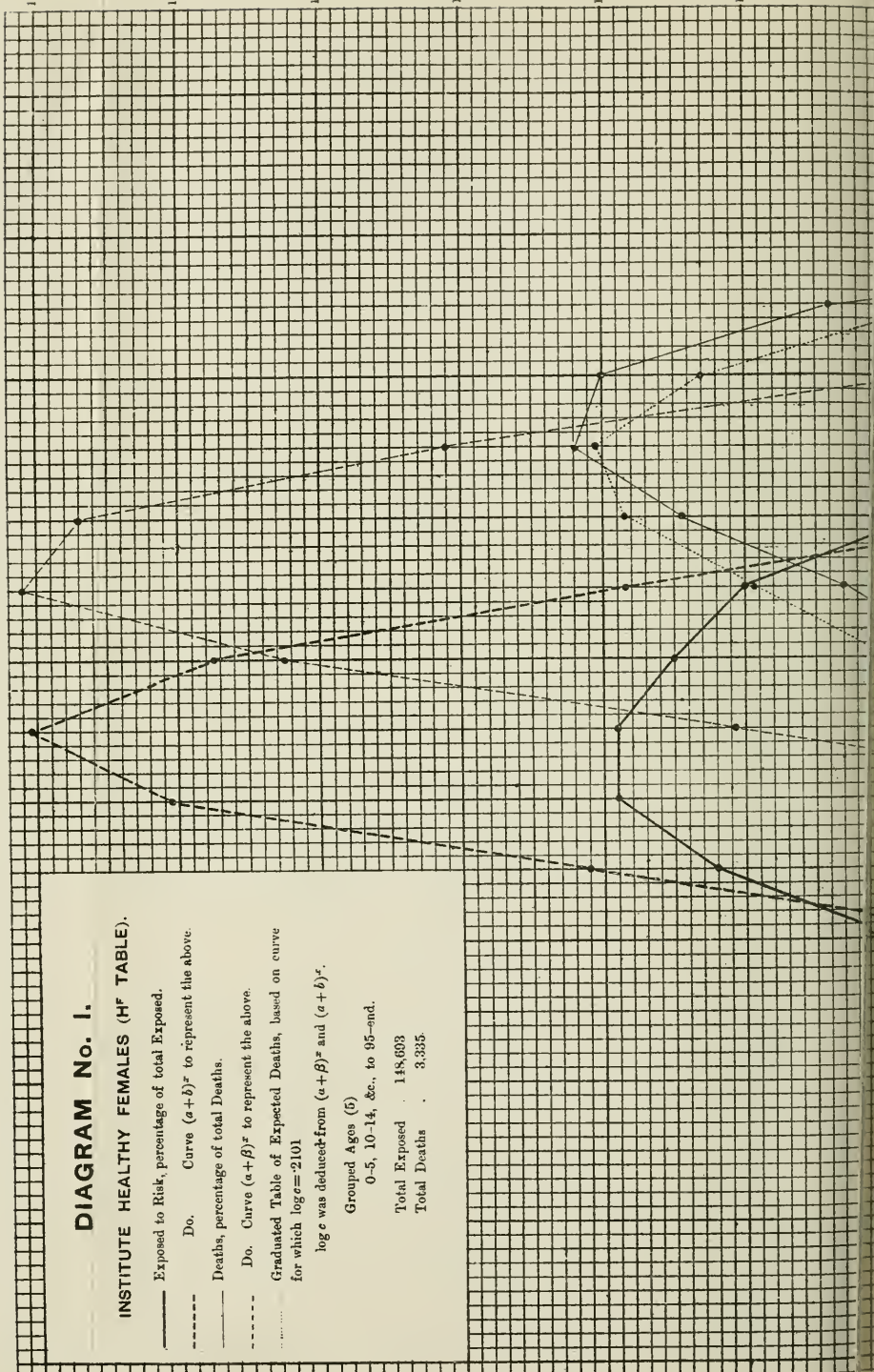
16.5

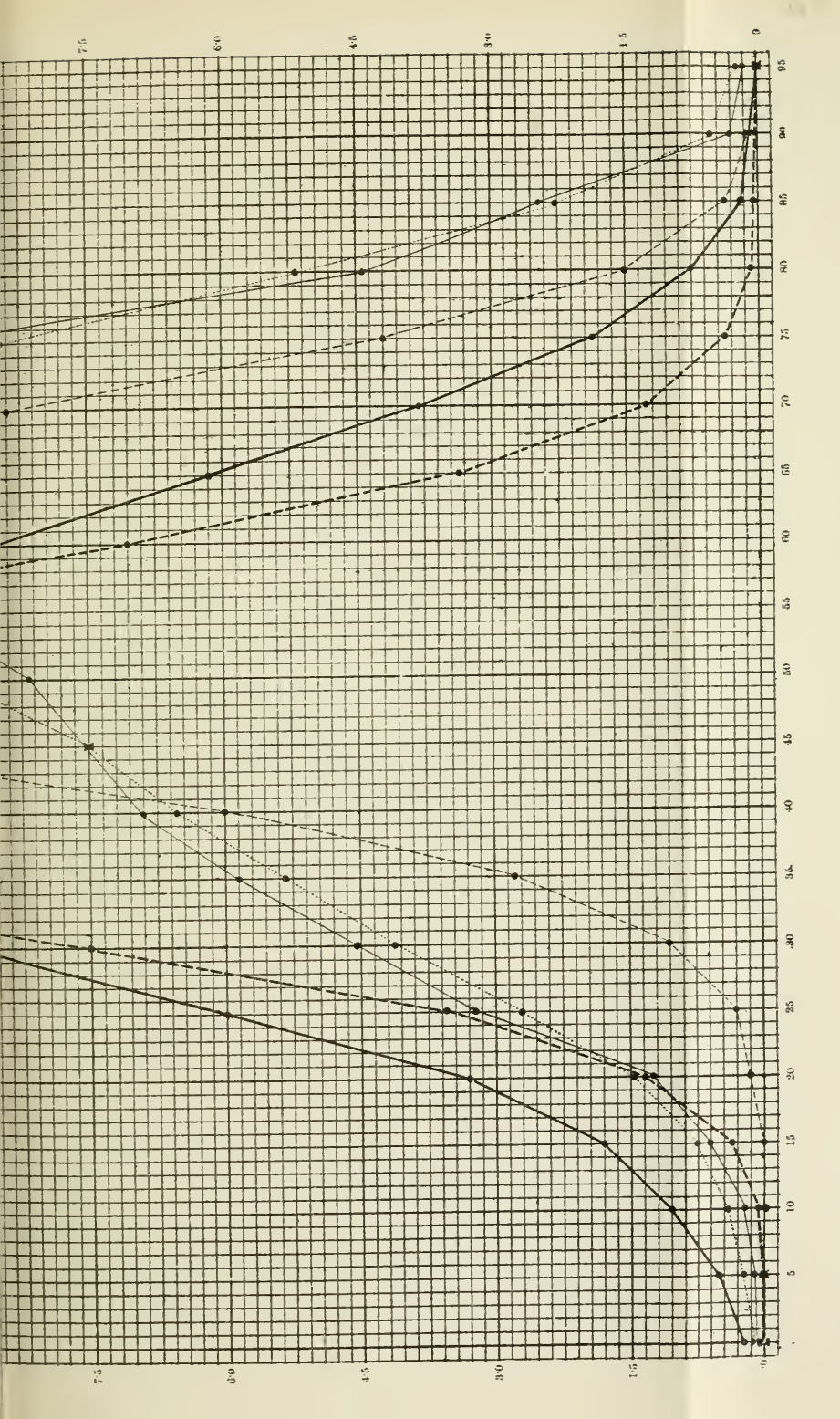
16.0

13.5

12.6

10.5







$$\text{and } \Sigma\theta = A\Sigma E(a+b)^n + B\Sigma E(a+bc)^n$$

$$\Sigma^2\theta = nb \cdot A\Sigma E(a+b)^{n-1} + nbcB\Sigma E(a+bc)^{n-1}$$

$$\Sigma^3\theta = \frac{n \cdot n-1}{2} b^2 A\Sigma E(a+b)^{n-2} + \frac{n \cdot n-1}{2} b^2 c^2 B\Sigma E(a+bc)^{n-2};$$

because  $\frac{x \cdot x-1}{2} \theta_x$  (the general term of the second

$$\text{summation}) = \frac{x \cdot x-1}{2} \cdot \frac{n \cdot n-1 \dots n-x-1}{x} \cdot a^{n-x} b^x (A + Bc^x) \Sigma E$$

$$= \frac{n \cdot n-1}{2} b^2 \cdot \frac{n-2 \cdot n-3-x+1}{x-2} a^{n-x} b^{x-2} A \Sigma E$$

$$+ \frac{n \cdot n-1}{2} b^2 c^2 \frac{n-2 \cdot n-3-n-x+1}{x-2} a^{n-x} (bc)^{x-2} B \Sigma E$$

$\Sigma^3\theta$ . stopping at the summation of  $(n-1)$  terms of  $\Sigma^2\theta$ .

Hence we obtain, writing  $\gamma$  for  $\frac{bc}{(a+bc)}$ , and  $B'$  for  $B(a+bc)^n$

$$\Sigma\theta = A\Sigma E + B'\Sigma E \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

$$\Sigma^2\theta = nbA\Sigma E + n\gamma \times B'\Sigma E \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

$$\Sigma^3\theta = \frac{n \cdot n-1}{2} b^2 A\Sigma E + \frac{n \cdot n-1}{2} b^2 \gamma^2 \Sigma E \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

$b$  having been already obtained by the relation  $\Sigma^2 E = nb\Sigma E$ , and we have only now to find the three constants  $A$ ,  $B'$  and  $\gamma$ , and thence the value of  $c$ .

It will be seen that for the Death curve we have, by going to a third summation, obtained a new curve intersecting the original curve for Deaths in 3 points in place of 2. The results on the whole for finding the value of  $c$  are not, therefore, perhaps quite so happy; as the new curve for Deaths will take a somewhat different form to that substituted for the Exposed to Risk.

In Table No. V, I give the results of an application of these two methods to the determination of the constants. As has been already said, the values of  $\log c$  found by Method A are those presumed to be found for a Gompertz formula without Makeham's modification, but whilst that formula was useful for determination of the one constant  $c$ , it was hardly suitable for finality; and the constants  $A$  and  $B$  were determined upon the plan of making the first and second summation of the errors vanish.

Similarly in Method B, the actual constants used were redetermined on the same basis.



In actual employment of the two Methods A and B, the construction of the two hypothetical curves for Deaths and Exposed is not directly necessary, the solution of equations (1) to (3) or (4) to (6) being all that is required for the determination of the value of  $\log c$ .

#### METHODS C & D.

By way of further experiment, I made trial of Methods C and D, which practically depart from the principle of deducing the constants from the Exposed to Risk and Death.

The results of these are given in Table No. VI, and the constants A and B having been finally determined upon the plan of the cancelment of the error and the accumulated error, it will be seen that so far as these items are concerned, the results are necessarily identical, but the third summation of the error now becomes very large, shewing that there is still a tendency for the deviations to lie too far to one end of the tables.

In Method C, I multiplied the rough rates of mortality obtained by the terms of the expansion  $(a+b)^n$  (as already found under Methods A and B for the Exposed to Risk), and hence by a system of three summations obtained the value of  $\log c$ . This merely had the effect of giving *weights* to the different rates proportional not to the original facts, but to the assumed curve, and hence in the middle of the table (where the rates are given a large excess of weight over the original Exposed, and that all the larger from the fact that the values at the extremities are depressed below the actual values), the deviations are very much smaller than those obtained by Methods A and B. In fact, it will be seen that the total error is now much smaller than in either of the two previous methods.

Feeling, however, that some better weight was required to be given to the incidence of the Deaths, I constructed the series  $(\sqrt{aa} + \sqrt{b\beta})^n$   $a$ ,  $b$ , and  $a$ ,  $\beta$  being those respectively derived from the Exposed to Risk and Deaths under Method A, and hence, obtaining a value of  $\log c$ ; and, afterwards redetermining the constants A and B, I obtained the results given in Table No. VI under the heading of Method D.

In these two Methods (C and D) it is necessary to actually construct the binomial series required, in order that their terms may be multiplied into the unadjusted rates of mortality.

In Diagram No. 1, I give the resultant curves of actual

Deaths, and Deaths expected by Method A as well as the hypothetical curves for both Deaths and Exposed from which the value of  $\log c$  was obtained. In view of the fact that the method used is a very approximate one, it is somewhat surprising to find the success which has been obtained in the way of general close agreement by Method A, for although the deviations are very large, and exceed in most cases the expected deviation, yet the error changes sign no less than six times, and it has seemed to me worth while to pursue the results of this graduation a step further. In all these cases, I employed, for the purpose of obtaining the constant, the groups of ages as given in the Tables, in each case multiplying the Exposed to Risk for the quinquennial groups by successive values of  $c^5$ , and some further observations hence become necessary.

In the columns headed "Expected Deviation" given under the original facts, I have given the value of  $\sqrt{6\theta}$  to the nearest integer, as an approximation, easy of calculation, to those values of probable error given by Mr. G. F. Hardy (*J.I.A.*, xxvii, 216), but I have also given in the case of each of the four methods followed a column headed "Deviation for one year of Age", which represents  $E_x Bc^x(c-1)$  or the increase in the Deaths, which could take place were all the lives one year older than assumed. This may be used as a corrective of the central age to obtain the results for the mean age, and also to calculate any change which it would seem legitimate to assume in the disposition of the actual numbers Exposed to Risk; for, without actual modification in the figures for the Exposed to Risk at each age, we have in this item a means of measuring the effect of the assumption that a certain proportion ( $r$ ) of the lives exposed might be rightly assumed to be either a year older or younger, as being possessed of a vitality not in correspondence with their years of life, which would account for some of the excess or defect in the actual Deaths set against the same age. The column of deviation so given will enable, by inspection, the discovery of the amount of such alteration necessary to bring the results of the graduation and the actual facts into closer agreement. It would seem to me, indeed, that these two factors, the difference between the true and central age, and the comparative senility of some of the lives, as affecting the reliability of the age, are entirely independent of and supplemental to such deviations as the theory of error would show to be probable, which relate to the expected departure in observations from a fixed ratio, solely as limited by the number of them.

As a corrective, however, of these two factors, I have given, in connection with Method A, certain small figures placed in the column headed Expected Deaths, with a sign to indicate addition to or subtraction from the actual Deaths. These are arbitrary figures based upon an attempt to find the smallest variations which would bring closer harmony between the actual and expected Deaths. A note of such a possible correction seems, too, to be desirable, on account of the rapid accumulation in successive summations of the small deviations arising from the substitution of integers for fractional quantities in the expected Deaths; *e.g.*, a difference of 1 in the first term of the Deviations will amount to 20 in the sum of the accumulated error and to 190 in the sum of the "Double accumulation"—which, in the case of a Table based on small facts, becomes a very appreciable although, nevertheless, a very unimportant matter.

Further, it will be noticed that an addition of 1 to the Expected Deaths for each of the first five and the last five groups of ages, with a deduction of 1 at each of the intermediate ages, will, without altering the total of the first and of the second summations of the deviation, reduce the third summation by 250.

In Table No. VII, I have given the figures obtained by Method A once more, with certain modifications and additions.

In the first place, I have inserted the mean age of the exposed in each group of ages, and, as is natural in a series of exposed rising to a maximum and then falling, the mean age is in excess of the central age at the commencement, gradually approaches it, and finally falls below it. I have, therefore, given the "Graduated Age", or the series of uniformly increasing ages nearest to the mean ages, such that the sum of the deviations between the two and the sum of the accumulated deviations, when each item is taken in proportion to the numbers exposed, shall in both cases be zero. It will appear then that the true increment in the ages (for the deviations are very small) is 4.96 and not 5, and that in the formula we must finally calculate  $\log c$  from the equation  $\log c^{4.96} = .2101$ .

I have next given effect to the modifications given under the head of minimum modification, which I have assumed not as a full or even scientific, but as a partial correction to the incidence of the Experience, in order to show how little change was required to secure very close total agreement, and it will now be seen that subject to these changes the fourth summation of the errors disappears.

In fact, inasmuch as the theory of a mortality curve is that the rates at consecutive ages are not independent, it would seem that either an actual grouping becomes necessary, by double or even treble summation of the Exposed to Risk, similar to those applied by Mr. J. A. Higham and others to the Rates of Mortality, so that each age should contribute weight to the neighbouring ages somewhat in proportion to its nearness; or else we may employ an embracing system like that of reproducing the total facts (leaving them, so to speak, to form their own groupings), and it would be hardly defensible to reproduce the actual Deaths, if we were held thereby to assume that the deviations between the expected and actual Deaths were errors in the full sense of the term, since, in such case, a real error found would, by the method of reproduction of the total facts, be made the basis for the creation of an additional error equal and opposite in its incidence.

It is not, however, necessary to actually modify the numbers exposed to risk for such purpose, since the indication of a modification in the actual Deaths will shew a similar result to that of a redistribution of the Exposed; again, equally met by a change in the assumed average age of the group under review.

In completing the graduation of the  $H^F$  Table, it, of course, became necessary, after obtaining the different values of  $\log c$ , which I have employed, to make use of some one or more methods to obtain the remaining constants. Those I have employed were such that by using the whole of the data, the deviations from the actual facts, when summed, and also when accumulated and summed, should, in the aggregate reduce to zero. I have, therefore, given certain facts and figures which should, in my opinion, have weight in any comparison of the different results; but, the purpose of these graduations being wholly to discuss certain devices in finding the value of  $\log c$ , I do not propose to enter into any discussion to-night as to the merits of one or more plans for obtaining the values of the constants A and B.

For these, I may say, I am largely indebted to Mr. G. F. Hardy, upon whose suggestion some sections of this paper were undertaken, and who has kindly placed at my disposal certain methods employed by him on a recent occasion when I had some opportunities of access to the processes there adopted, the defence or elucidation of the details of which, therefore, hardly fall within my province.

### NOTE III.—GRAPHIC METHOD OF SETTING-UP THE PROBABLE ERROR.

In diagrams, Nos. 2 and 3, I have set up certain rough values, as those to be graduated, which it will be seen are represented by two curves in lieu of one, the nature of which I now proceed to explain.

So far as I have been able to examine different authorities, I have failed to trace the solution of the Error problem in the form that seemed to be most suitable for the deduction that I here required, which was—given certain limited data—to find therefrom the two values, between which it was probable that the ratio among the total future observations (supposed to be infinite) between Deaths and Exposed would lie, and I have endeavoured to re-obtain the same upon the following basis.

Reverting to the fundamental problem in the Theory of Error, we have—

If an event has happened  $m$  times and failed  $n$  times in  $m+n$  trials, then the probability that on  $p+q$  further trials it shall happen  $p$  times and fail  $q$  times is—

$$\frac{p+q}{p \cdot q} \cdot \frac{m+p}{m} \cdot \frac{n+q}{n} \cdot \frac{m+n+1}{m+n+p+q+1}$$

By reduction this formula becomes—

$$\frac{m+n+1}{m \cdot n} \cdot \frac{(p+1 \cdot p+2 \cdot p+3 \dots p+m)(q+1 \cdot q+2 \cdot q+3 \dots q+n)}{p+q+1 \cdot p+q+2 \cdot p+q+3 \dots p+q+m+n \cdot p+q+m+n+1}$$

and assuming  $p$  and  $q$  to be very large as compared with  $m$  and  $n$ , we may substitute therefor—

$$\frac{m+n+1}{m \cdot n} \cdot \left(\frac{p}{p+q}\right)^m \cdot \left(\frac{q}{p+q}\right)^n \cdot \frac{1}{p+q+m+n+1}$$

and making

$$\frac{p}{p+q} = y \cdot \frac{q}{p+q} = 1-y \quad \text{and} \quad \frac{1}{p+q+m+n+1} = dy$$

(being the change that takes place in  $y$  by the addition of a new observation), we have

$$\frac{m+n+1}{m \cdot n} \cdot y^m (1-y)^n dy = \text{the probability that in an infinite}$$

number of future observations the ratio of the occurrences of a



particular event to the total number of observations is equal to  $y$ , and

$$\frac{\int_a^\beta \frac{m+n+1}{m \ n} y^m (1-y)^n dy}{\int_0^1 \frac{m+n+1}{m \ n} y^m (1-y)^n dy} = \frac{m+n+1}{m \ n} \int_a^\beta y^m (1-y)^n dy$$

represents the probability that such ratio lies between  $a$  and  $\beta$ .

The values at which the second differences of the curve under integration change sign are those for which

$$y = \frac{m}{m+n} \pm \frac{\sqrt{mn}}{(m+n) \sqrt{m+n-1}}$$

And, if for the sake of making the formula universal (*i.e.*, to apply when there are no deaths and no survivors), we substitute

$$a = \frac{m+1}{m+n+2} - \frac{\sqrt{(m+1)(n+1)}}{(m+n+2)^{\frac{3}{2}}} = q' - \frac{\sqrt{p'q'}}{\sqrt{E+2}}$$

$$\beta = \frac{m+1}{m+n+2} + \frac{\sqrt{(m+1)(n+1)}}{(m+n+2)^{\frac{3}{2}}} = q' + \frac{\sqrt{p'q'}}{\sqrt{E+2}}$$

we shall have a double curve between which about  $\frac{2}{3}$  of the values of the graduated curve may be expected to lie.

Such curve, however, is suited to the delineation of the values of  $q_x$ , but, as I proceed to show, is not directly applicable to the values of  $\mu_x$ .

The foundation of the problem of error is that of two complementary probabilities,  $q_x$  and  $p_x$ , both lying between 0 and 1, whilst  $\mu_x$  has no such complement, and has no limit.

The usual substitution for  $\mu_x$  for unadjusted purposes is the value of  $m_x$ , that is,  $\frac{q_x}{1-\frac{1}{2}q_x}$  and corresponding to this term we

have  $\frac{p_x}{1-\frac{1}{2}q_x} = 1 - \frac{1}{2}m_x$  the complement of  $\frac{1}{2}m_x$ , whilst the limiting values of  $m_x$  are 0 and 2.

In the case of the finding of the limiting values of  $m_x$  we should have to write  $2y = m_x$ , and the formula would become one for finding the limiting values of the probabilities of living and dying in the second half of the year, and then twice the latter will represent the limiting values of  $m_x$ .

It would seem, however, to be preferable to make the following substitution—

Let  $E - \frac{1}{2}\theta$  be the central Exposed to Risk, then the value

of the probability of living over the interval  $\frac{1}{\theta}$  of a year, at the commencement of which  $E - \frac{1}{2}\theta$  remain exposed and during which interval one life dies, will be—

$$\frac{E - \frac{1}{2}\theta - 1}{E - \frac{1}{2}\theta}$$

and writing  $m$  for  $E - \frac{1}{2}\theta$  we have—

$$\frac{\int_{\alpha}^{\beta} y^m (1-y) dy}{\int_0^1 y^m (1-y) dy}$$

for the probability that the future ratio of survivors to Exposed over the period  $\frac{1}{\theta}$  will fall between  $\alpha$  and  $\beta$ .

In order to get a fair review, duly weighted for the number of deaths, we must include the whole of the observed facts, which may be done by considering that we have a series of  $\theta$  observations, with the following data:

Interval 1.	E lives enter,	1 dies,	E-1 survive.
„ 2.	E-1 „ „	1 „	E-2 „
⋮	⋮		
„ $\theta$ .	E- $\theta+1$ „ „	1 „	E- $\theta$ „

So that for the whole year we have

$\theta[E - \frac{1}{2}(\theta - 1)]$  lives enter,  $\theta$  die, and  $[E - \frac{1}{2}(\theta + 1)]\theta$  survive the period  $\frac{1}{\theta}$ .

We may now substitute in the formula  $\frac{\sqrt{p'q'}}{\sqrt{E+2}}$  used for graphic purposes the number  $\theta[E - \frac{1}{2}(\theta - 1)]$  as the Exposed to Risk. As  $p$  now becomes  $\frac{E - \frac{1}{2}(\theta + 1)}{E - \frac{1}{2}(\theta - 1)}$  this item may be taken as unity, and observing that  $Eq = \theta$  (the number of deaths) we have  $\frac{\sqrt{\theta}}{\theta[E - \frac{1}{2}(\theta - 1)]}$  as the variation for  $\frac{1}{\theta}$  of a year, or  $\frac{\sqrt{\theta}}{E - \frac{1}{2}(\theta - 1)}$  for the variation in  $\mu_x$  for a whole year.

The values set up in Diagrams Nos. 2 and 3 as the limits of the probable value, are  $\frac{\theta}{E - \frac{1}{2}\theta} + \frac{\sqrt{\theta}}{E - \frac{1}{2}\theta}$  and  $\frac{\theta}{E - \frac{1}{2}\theta} - \frac{\sqrt{\theta}}{E - \frac{1}{2}\theta}$  the

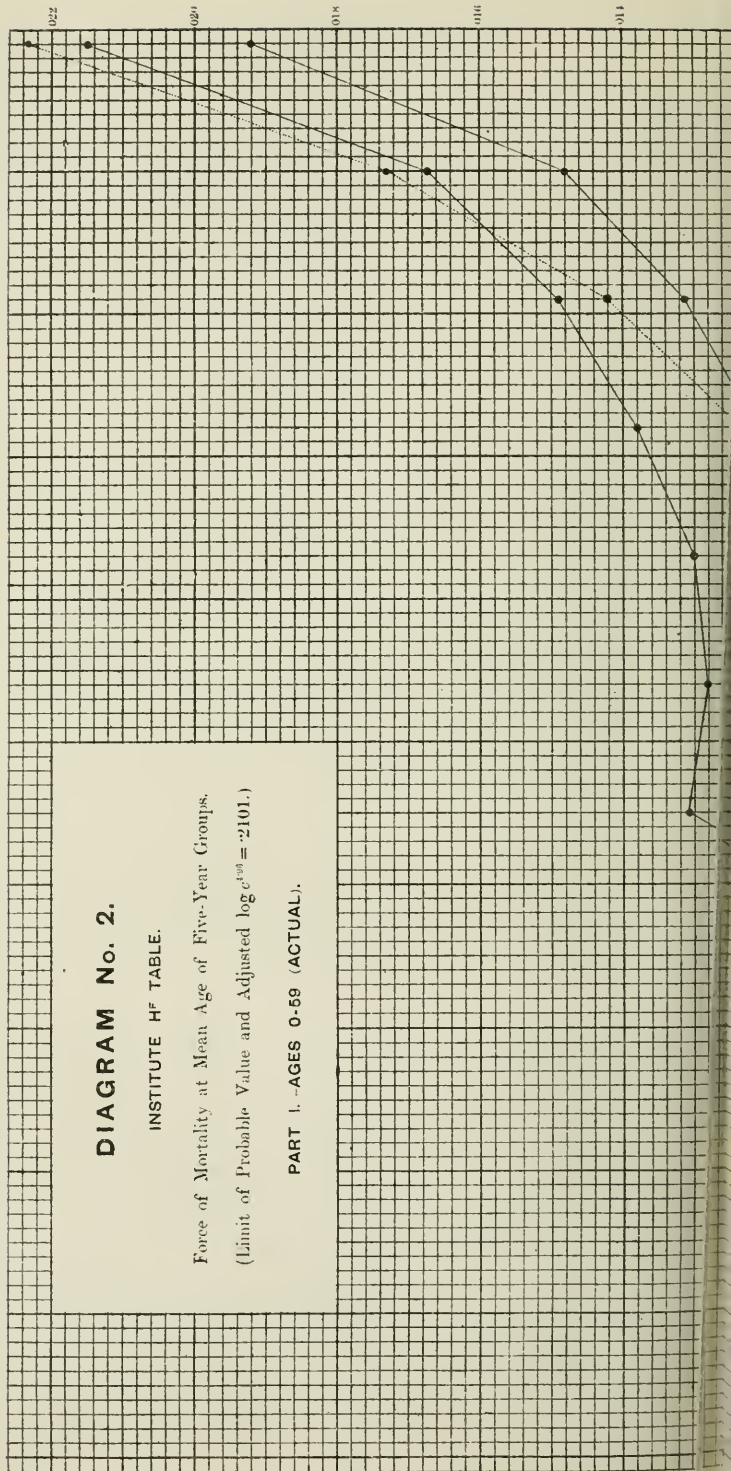


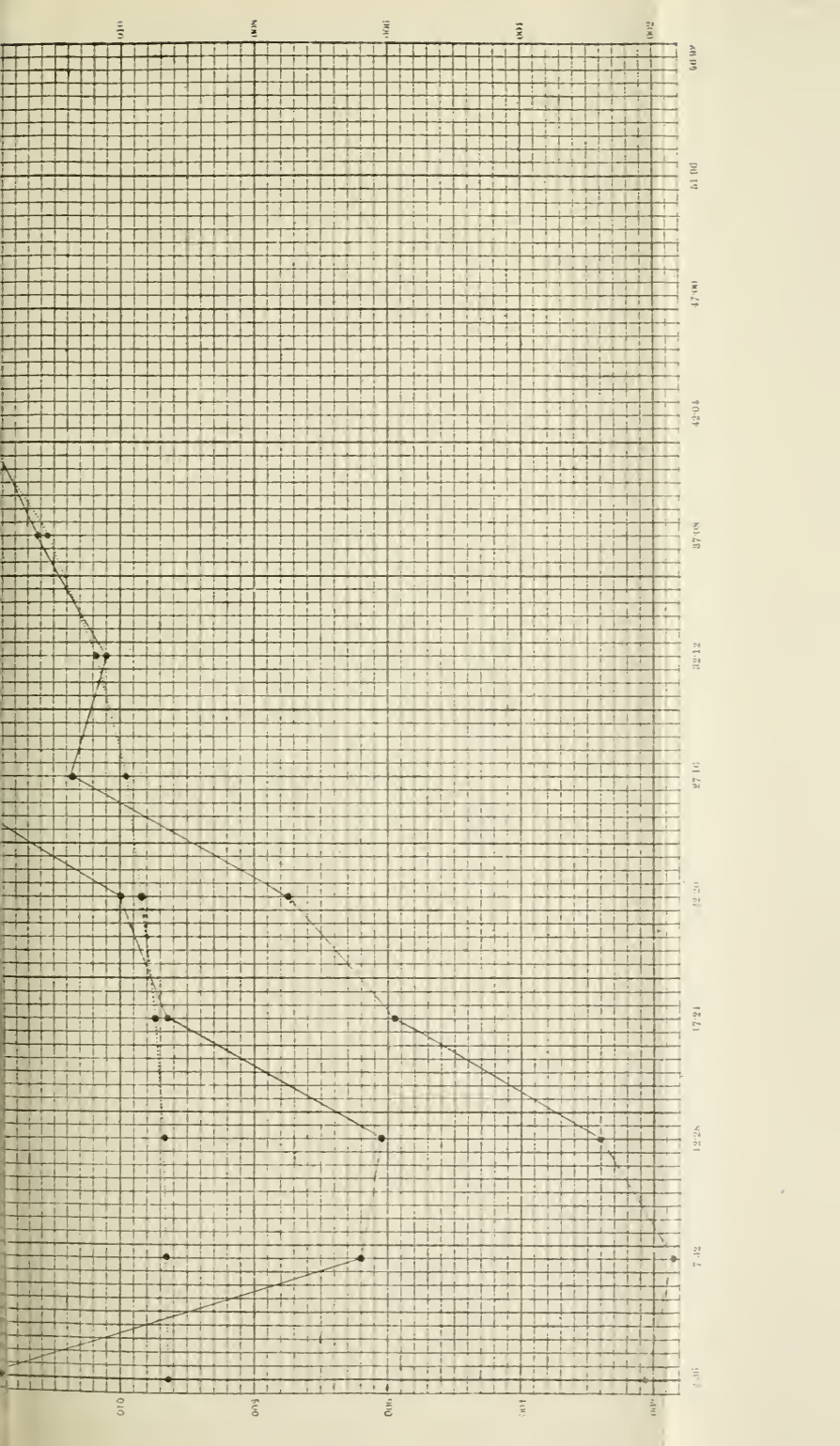
# **DIAGRAM No. 2.**

INSTITUTE H<sup>F</sup> TABLE.

Force of Mortality at Mean Age of Five-Year Groups,  
(Limit of Probable Value and Adjusted  $\log e^{t_{50}} = .2101$ .)

PART 1. AGES 0-59 (ACTUAL).









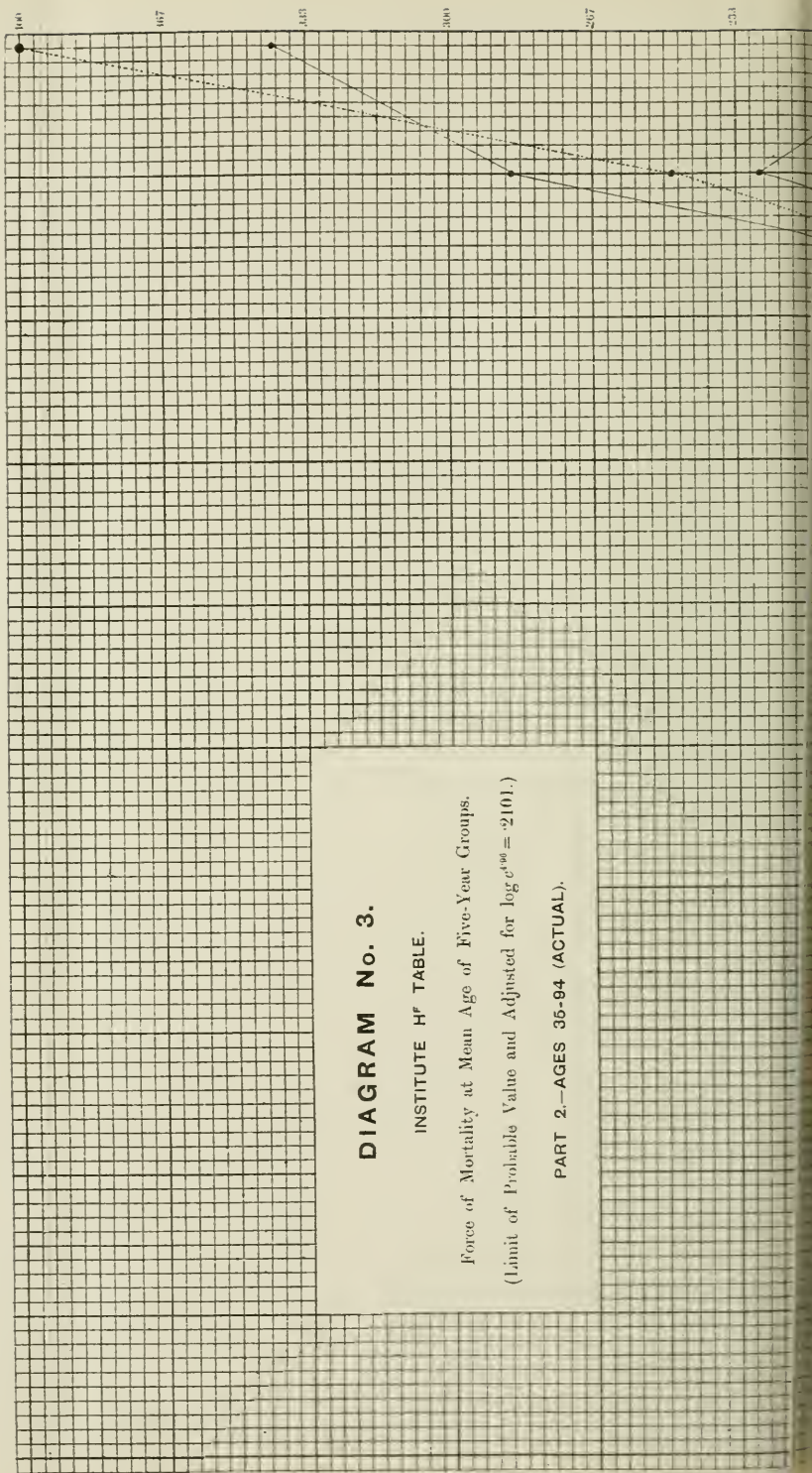


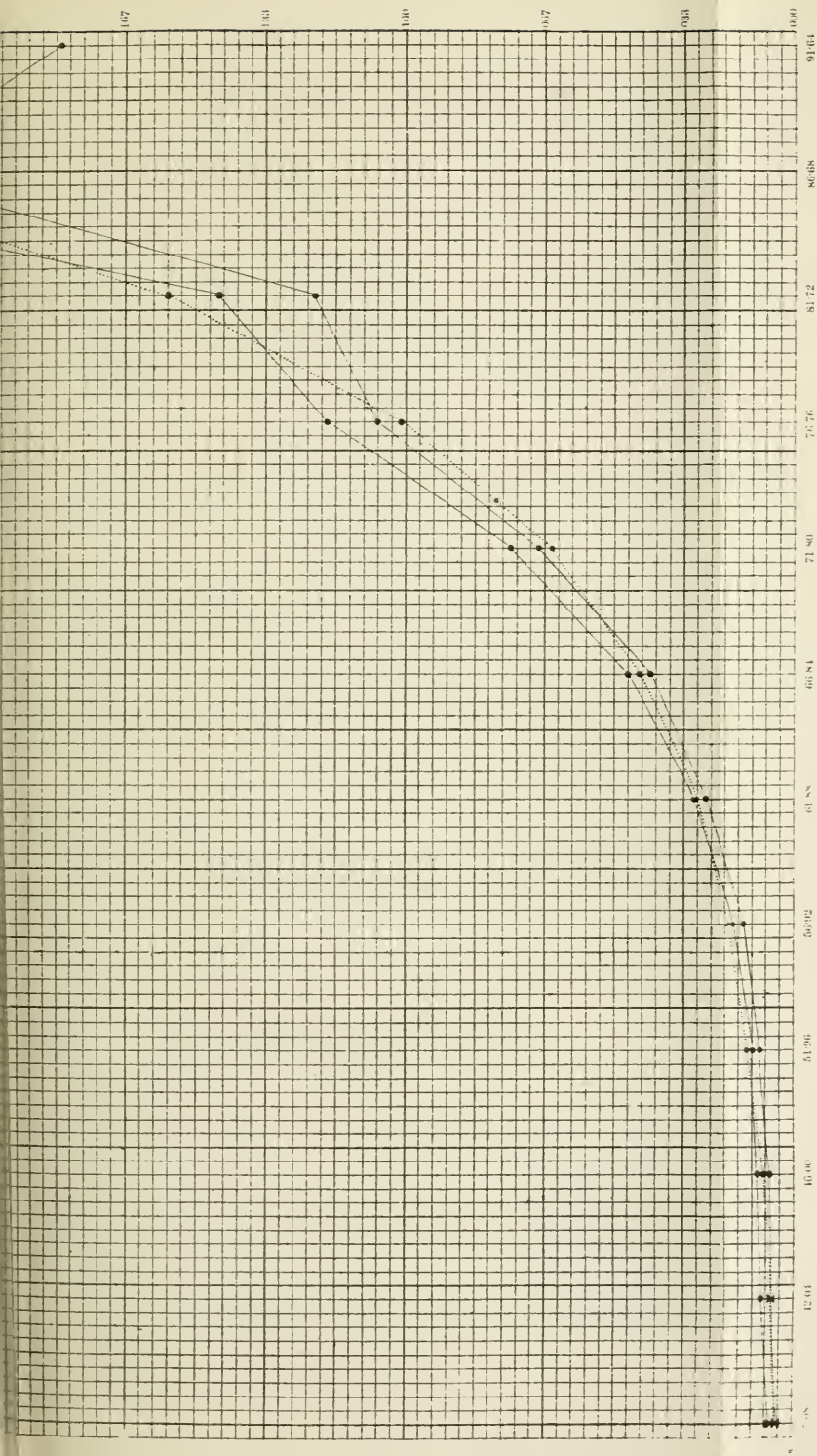
# DIAGRAM No. 3.

## INSTITUTE H<sup>F</sup> TABLE.

Force of Mortality at Mean Age of Five-Year Groups.  
(Limit of Probable Value and Adjusted for  $\log e^{400} = .2101$ .)

PART 2.—AGES 35-94 (ACTUAL).









modification in the denominator being scarcely necessary. It may be observed that we can hardly expect a larger probable deviation in the number of Expected Deaths, because we are seeking to graduate a different function of the Mortality Table, and hence I have retained for the "Expected Deviation" in Tables V, VI, and VII, that based on  $p$  and  $q$ ; but it is not to be forgotten that, in passing to the value of  $\mu_x$ , we virtually change the Exposed to Risk by a change in the number of Deaths, for if  $E$  be the lives exposed at the commencement of the year,  $\theta$  the actual deaths, and  $\epsilon$  the expected error, then  $m_x$  alters from

$$\frac{\theta}{E - \frac{1}{2}\theta} \text{ to } \frac{\theta + \epsilon}{E - \frac{1}{2}(\theta + \epsilon)}$$

#### NOTE IV.—MECHANICAL PROCESS FOR OBTAINING $\log c$ GRAPHICALLY.

It only remains for me to add some notes on a mechanical method of obtaining, through the graphic process, the value of  $\log c$ .

I have had constructed, at present somewhat roughly, the mechanical appliance which I here exhibit, for determining the interval of age  $a$ , for which  $a \frac{\mu_{x+a} - A}{\mu_x - A}$  has a given value.

It consists, as will be seen, of a certain number of brass strips, which are within the limits of their effective operation (*i.e.*, there is actually a certain margin for mechanical purposes) cut in a certain ratio. These have been cut to a breadth of  $\frac{1}{2}$  an inch, corresponding to four squares in the engine-ruled chart paper supplied by Messrs. C. & E. Layton, and are cut in the ratio of 1.5 to 1, the longest being the length of 121.5 squares of the same paper. These fit into a rule, whereon the  $\frac{1}{16}$  parts of an inch are accurately marked, and are made to slide thereon.

The logarithm of 1.5 being .1761, this will be the value of  $\log c^5$  when  $\log c = .0352$  per annum, or of  $\log c^4$  when  $\log c = .044$  per annum. If, therefore, the whole of a mortality curve be represented upon one sheet of chart paper with one square for each age, it is evident that if, when these brass rules are jammed tight up, they can be adapted to the rough curve, we shall obtain as our value of  $\log c$  for one year .044, but if one square has to be missed, we shall obtain the value of  $\log c$  .0352, and that for intermediate positions we shall obtain intermediate values.

The values of  $A$  will be obtained by measurement of the distance between the axis of  $X$  of the chart, and that of the moveable curve when fitted into position, whilst the value of  $B$  will be determined by the relative positions of the axes of  $Y$ .

I exhibit the model above referred to as an indication of what may be done in this direction, but I may say that there are various practical improvements which would require to be introduced to make the same a *working* model, as in the present form it is too heavy for the base. The best form of such a machine would be one wherein the uprights are attached to a cradle (or collapsible trellis), but on enquiry of a mathematical instrument maker, I could only ascertain that it would cost a considerable sum to make models before one could definitely ascertain the exact proportions and weights of the different parts requisite to give ease and accuracy of adjustment.

I have been led, therefore, to consider one or more alternative schemes for attaining the same result, and I now submit a design on tracing-cloth, which I have ascertained could, if necessary, be carried out on glass without undue expense.

In the diagram here exhibited, the curve passes over 100 squares of chart paper ( $12\frac{1}{2}$  inches) at the rate of  $\log c = .02$  for each square, and the curve is carried out with such minuteness as was found practicable on this scale, *i.e.*, the intervals measured are at the bottom of the curve, those for  $\log c = .2$  for 10 squares, then  $\log_{10} c = .1$  for 5 squares, and so on till we arrive at that part of the curve which it was possible to work to values of  $\log c = .02$  per square. The values corresponding to  $\log c^n = 1, 1.1, 1.2$  to  $2.0$  are specially picked out by thick lines, although all the values actually used in the drawing are given.

For values below  $\log c^n = 1$ , I have only drawn certain curves and given the lines cutting off ordinates of the requisite length, as well as the ordinates at every fifth square of the chart paper. Above  $\log_{10} c^n = 1$ , I have marked all the values employed in the diagram and have set the logarithms thereof against them.

I have then drawn 20 curves each of the same value, but corresponding to an axis of  $Y$  moved in each case  $\frac{1}{8}$  of an inch further to the right. If when this diagram is super-imposed upon any curve we wish to graduate, we can make one of these parallel curves coincide with values which we should be ready to adopt (the diagram being super-imposed in any position as regards the origins of the two curves, but without alteration of the direction of the axes), then the value of  $\log c$  will fall to be

determined by the value of  $x$  as measured on the chart of our ungraduated curve, *i.e.*, at 2 squares to an age we shall have  $\log c = .04$ . If, however, the most suitable curve seems to be that passing from a point  $A = g^a$  in one curve to a point  $B = g^b$  in any other curve ( $t$  curves distant), where  $\log g = .04$ , then the curve between these points will intersect each of the intervening  $(t-1)$  curves at distances, upon the axis of  $x$ ,  $\frac{b-a}{t}$  apart, and we shall now have that the value  $g^{b-a}$  corresponds to  $b-a+t$  squares in lieu of  $b-a$  squares (where  $t$  is positive if measured to the right on passing from lower to higher values of  $x$ , and negative in the opposite case) and we shall have  $\log c = \frac{b-a}{b-a+t} \times .04$ .

Since, then, by drawing the diagonal curves, we shall obtain curves covering the range of  $Bc^{x_1} = 1$  to  $Bc^{x_2} = 100$  over 120 and 80 squares respectively, giving  $\log c = .033$  and  $\log c = .05$  per two squares, we shall have a wide range for finding varying values of  $c$ .

We are, of course, not bound to any one number of squares per age, and may set up our parallel curves for any value of  $c$  per 1 square of paper for which each individual graduator may have a predilection, taking into account the number of squares he is using per age in his diagram and the range which he desires to give the possible values of  $c$ .

The values of  $A$  and  $B$  will be determined by the relative positions of the axes and the *numerical* values attached to each square on the chart setting out the ungraduated facts.

In thanking generally my colleagues of the Mortality Investigation for valuable assistance in checking formulæ, reading proofs, and many valuable suggestions, I must also express my indebtedness to Mr. E. Layton (of Messrs. C. & E. Layton) for very practical help in the investigation of the commercial possibilities of alternative graphic processes.

In conclusion, I can only say that it is in deep humility that I present myself before you for the first time with so ambitious a subject, and I fear that the task that I have set before me is one which my painful inexperience has dealt with very inadequately. My reading is, I fear, somewhat in arrear, and I may have repeated what others have much better said, or perhaps disproved, but I am encouraged to present these notes, knowing full well the patience and consideration which is uniformly shown to new contributors.

TABLE NO. I.

*Force of Mortality for interval, for which  $\log c = .005$ .*

$$\mu'_{n+t} = A + Bc^{n+t}$$

$n+t$	A = ·0000000	A = ·0002303	A = ·0004605	A = ·0006908	A = ·0009210	A = ·0011513
0	·0000022	·0002325	·0004627	·0006930	·0009232	·0011535
10	25	2328	4630	6933	9235	11538
20	28	2331	4633	6936	9238	11541
30	31	2334	4636	6939	9241	11544
40	35	2338	4640	6943	9245	11548
50	·0000039	·0002342	·0004644	·0006947	·0009249	·0011552
60	44	2347	4649	6952	9254	11557
70	50	2353	4655	6958	9260	11563
80	56	2359	4661	6964	9266	11569
90	62	2365	4667	6970	9272	11575
100	·0000070	·0002373	·0004675	·0006978	·0009280	·0011583
110	79	2382	4684	6987	9289	11592
120	88	2391	4693	6996	9298	11601
130	99	2402	4704	7007	9309	11612
140	·0000111	2414	4716	7019	9321	11624
150	·0000125	·0002428	·0004730	·0007033	·0009335	·0011638
160	140	2443	4745	7048	9350	11653
170	157	2460	4762	7065	9367	11670
180	176	2479	4781	7084	9386	11689
190	197	2500	4802	7105	9407	11710
200	·0000221	·0002524	·0004826	·0007129	·0009431	·0011734
210	248	2551	4853	7156	9458	11761
220	279	2582	4884	7187	9489	11792
230	313	2616	4918	7221	9523	11826
240	351	2654	4956	7259	9561	11864
250	·0000394	·0002697	·0004999	·0007302	·0009604	·0011907
260	442	2745	5047	7350	9652	11955
270	495	2798	5100	7403	9705	12008
280	556	2859	5161	7464	9766	12069
290	624	2927	5229	7532	9834	12137
300	·0000700	·0003003	·0005305	·0007608	·0009910	·0012213
310	785	3088	5390	7693	9995	12298
320	881	3184	5486	7789	·0010091	12394
330	989	3292	5594	7897	10199	12502
340	·0001109	3412	5714	8017	10319	12622
350	·0001245	·0003548	·0005850	·0008153	·0010455	·0012758
360	1396	3699	6001	8304	10606	12909
370	1567	3870	6172	8475	10777	13080
380	1758	4061	6363	8666	10968	13271
390	1972	4275	6577	8880	11182	13485
400	·0002213	·0004516	·0006818	·0009121	·0011423	·0013726
410	2483	4786	7088	9391	11693	13996
420	2786	5089	7391	9694	11996	14299
430	3126	5429	7731	·0010034	12336	14639
440	3508	5811	8113	10416	12718	15021
450	·0003936	·0006239	·0008541	·0010844	·0013146	·0015449
460	4416	6719	9021	11324	13626	15929
470	4955	7258	9560	11863	14165	16468
480	5559	7862	·0010164	12467	14769	17072
490	6237	8540	10842	13145	15447	17750

TABLE No. I—continued.

Force of Mortality for interval, for which  $\log c = .005$ .

$$\mu'_{n+t} = A + Bc^{n+t}$$

$n+t$	A = ·0000000	A = ·0002303	A = ·0004605	A = ·0006908	A = ·0009210	A = ·0011513
500	·0006698	·0009301	·0011603	·0013906	·0016208	·0018511
510	7852	·0010155	12457	14760	17062	19365
520	8810	11113	13415	15718	18020	20323
530	9886	12189	14491	16794	19096	21399
540	·001109	13393	15695	17998	20300	22613
550	·001245	·001475	·001706	·001936	·002166	·002396
560	1396	1626	1857	2087	2317	2547
570	1567	1797	2028	2258	2488	2718
580	1758	1988	2219	2449	2679	2909
590	1972	2202	2433	2663	2893	3123
600	·002213	·002443	·002674	·002904	·003134	·003364
610	2483	2713	2944	3174	3404	3634
620	2786	3016	3247	3477	3707	3937
630	3126	3356	3587	3817	4047	4277
640	3508	3738	3969	4199	4429	4659
650	·003936	·004266	·004497	·004727	·004957	·005187
660	4416	4646	4877	5107	5337	5567
670	4955	5185	5416	5646	5876	6106
680	5559	5789	6020	6250	6480	6710
690	6237	6467	6698	6928	7158	7488
700	·006998	·007228	·007459	·007689	·007919	·008149
710	7852	8082	8313	8543	8773	9003
720	8810	9040	9271	9501	9731	9961
730	9886	·010116	·010347	·010577	·010807	·011037
740	·01109	·011320	·011551	·011781	12011	12241
750	·01245	·01268	·01291	·01314	·01337	·01360
760	1396	1419	1442	1465	1488	1511
770	1567	1590	1613	1636	1659	1682
780	1758	1781	1804	1827	1850	1873
790	1972	1995	2018	2041	2064	2087
800	·02213	·02236	·02259	·02282	·02305	·02328
810	2483	2506	2529	2552	2575	2598
820	2786	2809	2832	2855	2878	2901
830	3126	3149	3172	3195	3218	3241
840	3508	3531	3554	3577	3600	3623
850	·03936	·03959	·03982	·04005	·04028	·04051
860	4416	4439	4462	4485	4508	4531
870	4955	4978	5001	5024	5047	5070
880	5559	5582	5605	5628	5651	5674
890	6237	6260	6283	6306	6329	6352
900	·06998	·07021	·07044	·07067	·07090	·07113
910	7852	7875	7898	7921	7944	7967
920	8810	8833	8856	8879	8902	8925
930	9886	9909	9932	9955	9978	10001
940	·1109	·11113	·11136	·11159	·11182	·11205
950	·1245	·1247	·1250	·1252	·1254	·1257
960	·1396	·1398	·1401	·1403	·1405	·1408
970	·1567	·1569	·1572	·1574	·1576	·1579
980	·1758	·1760	·1763	·1765	·1767	·1770
990	·1972	·1974	·1977	·1979	·1981	·1984



TABLE NO. II.

Complete Expectations of Life in terms of unit of time  $\tau$ , for  
which  $\log c = \cdot 005$ .  $\mu'_{n+t} = A + Bc^{n+t}$

$n+t$	$A =$ $\cdot 0000000$	$A =$ $\cdot 0002303$	$A =$ $\cdot 0004605$	$A =$ $\cdot 0006908$	$A =$ $\cdot 0009210$	$A =$ $\cdot 0011513$
0	693·307	639·582	591·428	548·188	509·297	474·246
10	683·323	631·060	584·148	541·966	503·976	469·691
20	673·341	622·520	576·837	535·702	498·606	465·084
30	663·361	613·962	569·493	529·397	493·188	460·426
40	653·383	605·385	562·117	523·049	487·721	455·714
50	643·407	596·792	554·710	516·660	482·206	450·950
60	633·433	588·181	547·270	510·228	476·642	446·133
70	623·463	579·552	539·799	503·754	471·028	441·262
80	613·495	570·907	532·296	497·237	465·365	436·337
90	603·531	562·245	524·761	490·678	459·652	431·358
100	593·571	553·567	517·195	484·077	453·889	426·323
110	583·614	544·872	509·597	477·434	448·077	421·234
120	573·663	536·161	501·968	470·748	442·214	416·089
130	563·716	527·436	494·309	464·021	436·300	410·888
140	553·774	518·695	486·619	457·251	428·337	405·631
150	543·839	509·940	478·899	450·439	424·323	400·318
160	533·910	509·170	471·149	443·586	418·258	394·949
170	523·988	492·388	463·370	436·691	412·144	389·522
180	514·074	483·592	455·562	429·756	405·980	384·040
190	504·169	474·785	447·726	422·780	399·765	378·500
200	494·273	465·966	439·862	415·763	393·501	372·904
210	484·388	457·137	431·972	408·708	387·188	367·252
220	474·514	448·299	424·056	401·613	380·836	361·543
230	464·652	439·452	416·114	394·480	374·425	355·778
240	454·805	430·597	408·148	387·310	367·957	349·957
250	444·972	421·737	400·160	380·103	361·451	344·081
260	435·155	412·872	392·149	372·860	354·899	338·151
270	425·357	404·003	384·118	365·584	348·302	332·166
280	415·577	395·133	376·068	358·274	341·661	326·128
290	405·819	386·262	368·000	350·932	334·976	320·038
300	396·084	377·393	359·917	343·560	328·249	313·897
310	386·374	368·528	351·819	336·160	321·482	307·705
320	376·691	359·680	343·710	328·733	314·676	301·466
330	367·038	350·819	335·591	321·281	307·833	295·178
340	357·417	341·979	327·464	313·807	300·966	288·846
350	347·832	333·153	319·334	306·313	294·045	282·470
360	338·284	324·343	311·201	298·802	287·104	276·053
370	328·777	315·553	303·070	291·276	280·136	269·508
380	319·315	306·785	294·942	283·739	273·143	263·106
390	309·900	298·045	286·823	276·194	266·128	256·582
400	300·538	289·334	278·716	268·645	259·095	250·027
410	291·232	280·658	270·625	261·095	252·048	243·446
420	281·986	272·021	262·553	253·549	244·991	236·842
430	272·804	263·427	254·506	246·012	237·926	230·220
440	263·692	254·882	246·489	238·487	230·861	223·584
450	254·654	246·400	238·506	230·980	223·799	216·937
460	245·697	237·956	230·564	223·497	216·746	210·287
470	236·825	229·587	222·667	216·042	209·707	203·637
480	228·044	221·289	214·821	208·625	202·688	196·995
490	219·360	213·067	207·034	201·247	195·694	190·365

TABLE NO. II—continued.

Complete Expectations of Life in terms of unit of time  $\tau$ , for  
which  $\log c = .005$ .  
 $\mu'_{n+t} = A + Bc^{n+t}$

$n+t$	$A = .0000000$	$A = .0002303$	$A = .0004605$	$A = .0006908$	$A = .0009210$	$A = .0011513$
500	210.781	204.928	199.311	193.916	188.734	183.752
510	202.311	196.880	191.660	186.640	181.813	177.167
520	193.958	188.927	184.087	179.426	174.939	170.514
530	185.729	181.079	176.600	172.281	168.119	164.102
540	177.630	173.341	169.206	165.213	161.360	157.638
550	169.669	165.722	161.912	158.230	154.671	151.229
560	161.853	158.229	154.727	151.338	148.060	144.885
570	154.189	150.870	147.658	144.547	141.533	138.612
580	146.684	143.651	140.713	137.864	135.101	132.420
590	139.345	136.581	133.900	131.298	128.772	126.317
600	132.179	129.667	127.228	124.857	122.553	120.311
610	125.194	122.916	120.703	118.548	116.453	114.412
620	118.397	116.335	114.332	112.380	110.480	108.627
630	111.785	109.931	108.124	106.361	104.642	102.965
640	105.377	103.712	102.085	100.497	98.948	97.434
650	99.174	97.681	96.222	94.796	93.403	92.042
660	93.179	91.847	90.543	89.266	88.018	86.796
670	87.399	86.212	85.050	83.910	82.796	81.703
680	81.836	80.782	79.749	78.736	77.744	76.770
690	76.493	75.561	74.646	73.748	72.868	72.003
700	71.371	70.551	69.743	68.950	68.171	67.406
710	66.476	65.754	65.044	64.346	63.660	62.984
720	61.805	61.174	60.551	59.938	59.336	58.742
730	57.360	56.809	56.265	55.729	55.202	54.681
740	53.138	52.660	52.186	51.719	51.260	50.805
750	49.139	48.725	48.314	47.909	47.510	47.115
760	45.357	45.003	44.648	44.298	43.953	43.609
770	41.801	41.491	41.186	40.883	40.586	40.289
780	38.449	38.185	37.923	37.664	37.407	37.153
790	35.307	35.082	34.858	34.635	34.416	34.198
800	32.366	32.173	31.982	31.793	31.607	31.423
810	29.622	29.458	29.295	29.138	28.979	28.822
820	27.065	26.924	26.786	26.651	26.518	26.390
830	24.691	24.570	24.452	24.336	24.222	24.110
840	22.490	22.389	22.289	22.191	22.094	21.998
850	20.457	20.372	20.288	20.205	20.122	20.044
860	18.579	18.511	18.444	18.378	18.314	18.251
870	16.850	16.792	16.735	16.679	16.625	16.572
880	15.265	15.217	15.170	15.123	15.079	15.034
890	13.811	13.771	13.732	13.694	13.657	13.621
900	12.480	12.446	12.413	12.382	12.352	12.323
910	11.266	11.238	11.211	11.185	11.160	11.137
920	10.158	10.134	10.111	10.090	10.070	10.051
930	9.151	9.131	9.112	9.095	9.079	9.064
940	8.236	8.220	8.205	8.191	8.178	8.167
950	7.407	7.393	7.380	7.368	7.357	7.347
960	6.655	6.643	6.632	6.622	6.613	6.606
970	5.975	5.965	5.956	5.948	5.941	5.936
980	5.359	5.351	5.344	5.338	5.333	5.329
990	4.807	4.799	4.793	4.788	4.784	4.781

TABLE NO. III.

$\mu'_{n+t} = Bc^{n+t}$						
$t$	$\log \mu'_t$ for interval $\tau$	100,000 $\times \mu'_t$	VALUES OF COMPLETE EXPECTATIONS IN TERMS OF UNIT OF TIME $\tau = \bar{e}_{n+t}$			$t$
		$B'c^t$	$n=400$	$n=600$	$n=800$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0	6.345	2213	300.538	132.179	32.366	0
1	3.50	2239	299.606	131.473	32.083	1
2	3.55	2265	298.673	130.768	31.802	2
3	3.60	2291	297.741	130.065	31.522	3
4	3.65	2317	296.809	129.364	31.245	4
5	3.70	2344	295.878	128.664	30.970	5
6	3.75	2371	294.948	127.966	30.696	6
7	3.80	2399	294.018	127.270	30.425	7
8	3.85	2427	293.089	126.576	30.155	8
9	3.90	2455	292.160	125.884	29.885	9
10	3.95	2483	291.232	125.194	29.622	10
11	4.00	2512	290.305	124.506	29.358	11
12	4.05	2541	289.378	123.819	29.096	12
13	4.10	2570	288.452	123.134	28.835	13
14	4.15	2600	287.526	122.451	28.577	14
15	4.20	2630	286.601	121.770	28.321	15
16	4.25	2661	285.677	121.091	28.066	16
17	4.30	2692	284.753	120.414	27.813	17
18	4.35	2723	283.830	119.741	27.562	18
19	4.40	2754	282.908	119.068	27.313	19
20	4.45	2786	281.986	118.397	27.065	20
21	4.50	2818	281.064	117.728	26.820	21
22	4.55	2851	280.144	117.060	26.576	22
23	4.60	2884	279.224	116.389	26.335	23
24	4.65	2917	278.305	115.725	26.095	24
25	4.70	2951	277.387	115.064	25.857	25
26	4.75	2985	276.469	114.404	25.620	26
27	4.80	3020	275.552	113.747	25.384	27
28	4.85	3055	274.635	113.091	25.151	28
29	4.90	3090	273.719	112.437	24.920	29
30	4.95	3126	272.804	111.785	24.691	30
31	5.00	3162	271.890	111.135	24.463	31
32	5.05	3199	270.976	110.487	24.237	32
33	5.10	3236	270.063	109.841	24.012	33
34	5.15	3273	269.151	109.197	23.790	34
35	5.20	3311	268.239	108.555	23.569	35
36	5.25	3350	267.328	107.916	23.350	36
37	5.30	3388	266.418	107.278	23.132	37
38	5.35	3428	265.509	106.642	22.917	38
39	5.40	3467	264.600	106.008	22.702	39
40	5.45	3508	263.692	105.377	22.490	40
41	5.50	3548	262.785	104.747	22.280	41
42	5.55	3589	261.878	104.120	22.070	42
43	5.60	3631	260.973	103.494	21.863	43
44	5.65	3673	260.068	102.871	21.658	44
45	5.70	3715	259.164	102.249	21.453	45
46	5.75	3758	258.260	101.630	21.250	46
47	5.80	3802	257.358	101.013	21.050	47
48	5.85	3846	256.456	100.398	20.851	48
49	5.90	3890	255.555	99.785	20.653	49

TABLE NO. III—continued.

$\mu'_{n+t} = Bc^{n+t}$						
$t$	$\log \mu'_t$ for interval $\tau$	100,000 $\times \mu'_t$	VALUES OF COMPLETE EXPECTATIONS IN TERMS OF UNIT OF TIME $\tau = \frac{1}{c}$			$t$
(1)	(2)	$B'c^t$ (3)	$n = 400$ (4)	$n = 600$ (5)	$n = 800$ (6)	(7)
50	6.595	3936	254.654	99.174	20.457	50
51	6.600	3981	253.755	98.565	20.262	51
52	6.605	4027	252.858	97.958	20.069	52
53	6.610	4074	251.959	97.353	19.877	53
54	6.615	4121	251.062	96.750	19.687	54
55	6.620	4169	250.165	96.150	19.499	55
56	6.625	4217	249.270	95.552	19.311	56
57	6.630	4266	248.376	94.956	19.126	57
58	6.635	4315	247.482	94.361	18.942	58
59	6.640	4365	246.589	93.769	18.760	59
60	6.645	4416	245.697	93.179	18.579	60
61	6.650	4467	244.806	92.592	18.399	61
62	6.655	4519	243.916	92.006	18.221	62
63	6.660	4571	243.026	91.423	18.045	63
64	6.665	4624	242.138	90.842	17.870	64
65	6.670	4677	241.250	90.262	17.696	65
66	6.675	4732	240.363	89.685	17.524	66
67	6.680	4786	239.477	89.110	17.353	67
68	6.685	4842	238.592	88.539	17.184	68
69	6.690	4898	237.708	87.967	17.016	69
70	6.695	4955	236.825	87.399	16.850	70
71	6.700	5012	235.943	86.833	16.685	71
72	6.705	5070	235.061	86.269	16.521	72
73	6.710	5129	234.181	85.707	16.359	73
74	6.715	5188	233.301	85.147	16.199	74
75	6.720	5248	232.423	84.590	16.039	75
76	6.725	5309	231.545	84.035	15.881	76
77	6.730	5370	230.668	83.482	15.728	77
78	6.735	5443	229.793	82.931	15.572	78
79	6.740	5495	228.918	82.383	15.418	79
80	6.745	5559	228.044	81.836	15.265	80
81	6.750	5623	227.171	81.291	15.114	81
82	6.755	5689	226.299	80.750	14.965	82
83	6.760	5754	225.428	80.210	14.816	83
84	6.765	5821	224.558	79.672	14.669	84
85	6.770	5888	223.690	79.137	14.522	85
86	6.775	5957	222.822	78.604	14.378	86
87	6.780	6026	221.955	78.072	14.234	87
88	6.785	6095	221.089	77.544	14.092	88
89	6.790	6166	220.224	77.017	13.951	89
90	6.795	6237	219.360	76.493	13.811	90
91	6.800	6310	218.498	75.971	13.673	91
92	6.805	6383	217.636	75.451	13.536	92
93	6.810	6457	216.775	74.933	13.400	93
94	6.815	6531	215.916	74.418	13.265	94
95	6.820	6607	215.057	73.905	13.130	95
96	6.825	6683	214.200	73.394	12.998	96
97	6.830	6761	213.343	72.885	12.867	97
98	6.835	6839	212.488	72.379	12.737	98
99	6.840	6918	211.634	71.875	12.608	99



TABLE NO. III—continued.

$\mu'_{n+t} = B e^{n+t}$						
$t$	$\log \mu'_t$ for interval $\tau$	100,000 $\times \mu'_t$	VALUES OF COMPLETE EXPECTATIONS IN TERMS OF UNIT OF TIME $\tau = \frac{1}{\mu'_{n+t}}$			$t$
		$B' e^t$	$n = 400$	$n = 600$	$n = 800$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
100	6.845	.6998	210.781	71.371	12.480	100
101	.850	.7079	209.929	70.873	12.354	101
102	.855	.7161	209.078	70.375	12.228	102
103	.860	.7244	208.228	69.880	12.104	103
104	.865	.7328	207.379	69.387	11.981	104
105	.870	.7413	206.532	68.896	11.859	105
106	.875	.7499	205.685	68.408	11.738	106
107	.880	.7586	204.840	67.921	11.618	107
108	.885	.7674	203.996	67.437	11.500	108
109	.890	.7762	203.153	66.956	11.382	109
110	.895	.7852	202.311	66.476	11.266	110
111	.900	.7943	201.471	65.999	11.150	111
112	.905	.8035	200.631	65.524	11.036	112
113	.910	.8128	199.793	65.051	10.923	113
114	.915	.8222	198.956	64.581	10.810	114
115	.920	.8318	198.120	64.113	10.699	115
116	.925	.8414	197.285	63.647	10.589	116
117	.930	.8511	196.458	63.183	10.480	117
118	.935	.8610	195.619	62.721	10.372	118
119	.940	.8710	194.788	62.262	10.264	119
120	.945	.8810	193.958	61.805	10.158	120
121	.950	.8913	193.130	61.350	10.053	121
122	.955	.9016	192.302	60.898	9.949	122
123	.960	.9120	191.476	60.448	9.846	123
124	.965	.9226	190.651	60.000	9.744	124
125	.970	.9333	189.828	59.554	9.643	125
126	.975	.9441	189.006	59.112	9.543	126
127	.980	.9550	188.184	58.670	9.443	127
128	.985	.9661	187.365	58.231	9.345	128
129	.990	.9772	186.546	57.794	9.247	129
130	.995	.9886	185.729	57.360	9.151	130
131	5.000	1.000	184.913	56.927	9.055	131
132	.005	1.012	184.099	56.497	8.961	132
133	.010	1.023	183.285	56.070	8.867	133
134	.015	1.035	182.473	55.644	8.774	134
135	.020	1.047	181.663	55.221	8.682	135
136	.025	1.059	180.854	54.800	8.591	136
137	.030	1.072	180.046	54.381	8.501	137
138	.035	1.084	179.239	53.965	8.412	138
139	.040	1.096	178.434	53.550	8.324	139
140	.045	1.109	177.630	53.138	8.236	140
141	.050	1.122	176.828	52.728	8.149	141
142	.055	1.135	176.027	52.321	8.063	142
143	.060	1.148	175.227	51.915	7.979	143
144	.065	1.161	174.429	51.512	7.894	144
145	.070	1.175	173.632	51.111	7.811	145
146	.075	1.189	172.837	50.712	7.729	146
147	.080	1.202	172.043	50.316	7.647	147
148	.085	1.216	171.250	49.921	7.566	148
149	.090	1.230	170.459	49.529	7.486	149



TABLE NO. III—continued.

$\mu'_{n+t} = Bc^{n+t}$						
$t$	$\log \mu'_t$ for interval $\tau$	100,000 $\times \mu'_t$	VALUES OF COMPLETE EXPECTATIONS IN TERMS OF UNIT OF TIME $\tau = \frac{1}{c}$			$t$
		$B'c^t$	$n=400$	$n=600$	$n=800$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
150	·095	1·245	169·669	49·139	7·407	150
151	·100	1·259	168·881	48·751	7·328	151
152	·105	1·274	168·094	48·366	7·250	152
153	·110	1·288	167·309	47·982	7·174	153
154	·115	1·303	166·525	47·601	7·098	154
155	·120	1·318	165·743	47·222	7·022	155
156	·125	1·334	164·962	46·845	6·948	156
157	·130	1·349	164·182	46·471	6·873	157
158	·135	1·365	163·404	46·098	6·800	158
159	·140	1·380	162·628	45·725	6·727	159
160	·145	1·396	161·853	45·357	6·655	160
161	·150	1·413	161·080	44·991	6·584	161
162	·155	1·429	160·308	44·627	6·513	162
163	·160	1·445	159·538	44·265	6·445	163
164	·165	1·462	158·769	43·903	6·376	164
165	·170	1·479	158·002	43·546	6·305	165
166	·175	1·496	157·236	43·191	6·237	166
167	·180	1·514	156·472	42·837	6·169	167
168	·185	1·531	155·709	42·486	6·103	168
169	·190	1·549	154·948	42·147	6·039	169
170	·195	1·567	154·189	41·801	5·975	170
171	·200	1·585	153·431	41·456	5·911	171
172	·205	1·603	152·675	41·114	5·847	172
173	·210	1·622	151·920	40·773	5·783	173
174	·215	1·641	151·167	40·436	5·720	174
175	·220	1·660	150·416	40·099	5·658	175
176	·225	1·679	149·666	39·773	5·598	176
177	·230	1·698	148·918	39·432	5·538	177
178	·235	1·718	148·172	39·102	5·478	178
179	·240	1·738	147·427	38·775	5·419	179
180	·245	1·758	146·684	38·449	5·359	180
181	·250	1·778	145·942	38·126	5·301	181
182	·255	1·799	145·202	37·804	5·243	182
183	·260	1·820	144·464	37·485	5·287	183
184	·265	1·841	143·728	37·168	5·131	184
185	·270	1·862	142·993	36·852	5·075	185
186	·275	1·884	142·260	36·539	5·020	186
187	·280	1·906	141·529	36·228	4·966	187
188	·285	1·928	140·799	36·919	4·912	188
189	·290	1·950	140·071	35·612	4·859	189
190	·295	1·972	139·345	35·307	4·807	190
191	·300	1·995	138·620	35·004	4·754	191
192	·305	2·018	137·898	34·703	4·702	192
193	·310	2·042	137·177	34·404	4·651	193
194	·315	2·065	136·458	34·107	4·600	194
195	·320	2·089	135·740	33·812	4·550	195
196	·325	2·113	135·024	33·518	4·500	196
197	·330	2·138	134·311	33·227	4·451	197
198	·335	2·163	133·598	32·938	4·403	198
199	·340	2·188	132·886	32·651	4·355	199

TABLE NO. IV.

$\mu'_{n+t} = A + Bc^{n+t}$ $A = 00115125$ for interval $\tau$						
$t$	$\log(\mu'_t - A)$ for interval $\tau$	100,000 $\times (\mu'_t - A)$	VALUES OF COMPLETE EXPECTATIONS IN TERMS OF UNIT OF TIME $\tau = \bar{e}_{n+t}$			$t$
(1)	(2)	$B'c^t$ (3)	$n = 400$ (4)	$n = 600$ (5)	$n = 800$ (6)	(7)
0	$\bar{6} \cdot 345$	$\cdot 2213$	250·027	120·311	31·423	0
1	$\cdot 350$	$\cdot 2239$	249·370	119·716	31·155	1
2	$\cdot 355$	$\cdot 2365$	248·713	119·122	30·888	2
3	$\cdot 360$	$\cdot 2291$	248·055	118·530	30·624	3
4	$\cdot 365$	$\cdot 2317$	247·398	117·938	30·361	4
5	$\cdot 370$	$\cdot 2344$	246·740	117·348	30·102	5
6	$\cdot 375$	$\cdot 2371$	246·082	116·758	29·841	6
7	$\cdot 380$	$\cdot 2399$	245·423	116·170	29·584	7
8	$\cdot 385$	$\cdot 2427$	244·764	115·583	29·328	8
9	$\cdot 390$	$\cdot 2455$	244·105	114·997	29·074	9
10	$\cdot 395$	$\cdot 2483$	243·446	114·412	28·822	10
11	$\cdot 400$	$\cdot 2512$	242·787	113·828	28·572	11
12	$\cdot 405$	$\cdot 2541$	242·127	113·246	28·323	12
13	$\cdot 410$	$\cdot 2570$	221·467	112·664	28·076	13
14	$\cdot 415$	$\cdot 2600$	220·807	112·083	27·830	14
15	$\cdot 420$	$\cdot 2630$	240·147	111·504	27·586	15
16	$\cdot 425$	$\cdot 2661$	239·486	110·926	27·343	16
17	$\cdot 430$	$\cdot 2692$	239·826	110·349	27·102	17
18	$\cdot 435$	$\cdot 2723$	238·165	109·774	26·863	18
19	$\cdot 440$	$\cdot 2754$	237·504	109·200	26·626	19
20	$\cdot 445$	$\cdot 2786$	236·842	108·627	26·390	20
21	$\cdot 450$	$\cdot 2818$	236·181	108·055	26·156	21
22	$\cdot 455$	$\cdot 2851$	235·519	107·484	25·913	22
23	$\cdot 460$	$\cdot 2884$	234·857	106·915	25·581	23
24	$\cdot 465$	$\cdot 2917$	234·195	106·346	25·452	24
25	$\cdot 470$	$\cdot 2951$	233·533	105·780	25·224	25
26	$\cdot 475$	$\cdot 2985$	232·871	105·214	24·998	26
27	$\cdot 480$	$\cdot 3020$	232·208	104·650	24·773	27
28	$\cdot 485$	$\cdot 3055$	231·546	104·087	24·550	28
29	$\cdot 490$	$\cdot 3090$	230·883	103·525	24·330	29
30	$\cdot 495$	$\cdot 3126$	230·220	102·965	24·110	30
31	$\cdot 500$	$\cdot 3162$	229·557	102·406	23·892	31
32	$\cdot 505$	$\cdot 3199$	228·894	101·848	23·675	32
33	$\cdot 510$	$\cdot 3236$	228·230	101·291	23·460	33
34	$\cdot 515$	$\cdot 3273$	227·567	100·736	23·247	34
35	$\cdot 520$	$\cdot 3311$	226·903	100·182	23·035	35
36	$\cdot 525$	$\cdot 3350$	226·239	99·630	22·824	36
37	$\cdot 530$	$\cdot 3388$	225·576	99·079	22·615	37
38	$\cdot 535$	$\cdot 3428$	224·912	98·529	22·408	38
39	$\cdot 540$	$\cdot 3467$	224·248	97·981	22·202	39
40	$\cdot 545$	$\cdot 3508$	223·584	97·434	21·998	40
41	$\cdot 550$	$\cdot 3548$	222·919	96·888	21·795	41
42	$\cdot 555$	$\cdot 3589$	222·255	96·344	21·594	42
43	$\cdot 560$	$\cdot 3631$	221·590	95·801	21·395	43
44	$\cdot 565$	$\cdot 3673$	220·926	95·260	21·197	44
45	$\cdot 570$	$\cdot 3715$	220·261	94·720	21·000	45
46	$\cdot 575$	$\cdot 3758$	219·597	94·181	20·805	46
47	$\cdot 580$	$\cdot 3802$	218·932	93·644	20·611	47
48	$\cdot 585$	$\cdot 3846$	218·268	93·109	20·419	48
49	$\cdot 590$	$\cdot 3890$	217·602	92·575	20·233	49

TABLE NO. IV—continued.

$\mu'_{n+t} = A + Bc^{n+t}$			A = 00115125 for interval $\tau$			
$t$	$\log(\mu'_t - A)$ for interval $\tau$	100,000 $\times (\mu'_t - A)$	VALUES OF COMPLETE EXPECTATIONS IN TERMS OF UNIT OF TIME $\tau = \frac{1}{e_{n+t}}$			$t$
(1)	(2)	B' $c^t$ (3)	$n = 400$ (4)	$n = 600$ (5)	$n = 800$ (6)	(7)
50	6.595	.3936	216.937	92.042	20.044	50
51	.600	.3981	216.272	91.511	19.856	51
52	.605	.4027	215.607	90.981	19.670	52
53	.610	.4074	214.943	90.453	19.486	53
54	.615	.4121	214.278	89.926	19.301	54
55	.620	.4169	213.613	89.400	19.119	55
56	.625	.4217	212.947	88.877	18.938	56
57	.630	.4266	212.282	88.354	18.759	57
58	.635	.4315	211.617	87.833	18.581	58
59	.640	.4365	210.952	87.314	18.426	59
60	.645	.4416	210.287	86.796	18.251	60
61	.650	.4467	209.622	86.280	18.078	61
62	.655	.4519	208.957	85.765	17.907	62
63	.660	.4571	208.292	85.252	17.737	63
64	.665	.4624	207.627	84.740	17.568	64
65	.670	.4677	206.962	84.230	17.390	65
66	.675	.4732	206.297	83.722	17.224	66
67	.680	.4786	205.632	83.215	17.059	67
68	.685	.4842	204.967	82.709	16.895	68
69	.690	.4898	204.302	82.205	16.733	69
70	.695	.4955	203.637	81.703	16.572	70
71	.700	.5012	202.973	81.203	16.413	71
72	.705	.5070	202.308	80.704	16.255	72
73	.710	.5129	201.643	80.206	16.098	73
74	.715	.5188	200.979	79.711	15.942	74
75	.720	.5248	200.315	79.217	15.788	75
76	.725	.5309	199.651	78.724	15.634	76
77	.730	.5370	198.987	78.233	15.482	77
78	.735	.5433	198.323	77.744	15.331	78
79	.740	.5495	197.659	77.256	15.182	79
80	.745	.5559	196.995	76.770	15.034	80
81	.750	.5623	196.331	76.286	14.887	81
82	.755	.5689	195.668	75.803	14.741	82
83	.760	.5754	195.004	75.322	14.596	83
84	.765	.5821	194.341	74.843	14.453	84
85	.770	.5888	193.678	74.366	14.311	85
86	.775	.5957	193.015	73.889	14.171	86
87	.780	.6026	192.352	73.415	14.031	87
88	.785	.6095	191.689	72.943	13.894	88
89	.790	.6166	191.027	72.472	13.757	89
90	.795	.6237	190.365	72.003	13.621	90
91	.800	.6310	189.701	71.535	13.486	91
92	.805	.6383	189.039	71.069	13.352	92
93	.810	.6457	188.378	70.605	13.220	93
94	.815	.6531	187.716	70.143	13.087	94
95	.820	.6607	187.055	69.683	12.957	95
96	.825	.6683	186.394	69.224	12.828	96
97	.830	.6761	185.733	68.767	12.700	97
98	.835	.6839	185.073	68.311	12.573	98
99	.840	.6918	184.412	67.858	12.447	99

TABLE No. IV—continued.

$\mu'_{n+t} = A + Bc^{n+t}$ $A = 00115125$ for interval $\tau$						
$t$	$\log(\mu'_t - A)$ for interval $\tau$	100,000 $\times(\mu'_t - A)$	VALUES OF COMPLETE EXPECTATIONS IN TERMS OF UNIT OF TIME $\tau = \frac{1}{c} \ln(1+c)$			$t$
(1)	(2)	$B'c^t$ (3)	$n=400$ (4)	$n=600$ (5)	$n=800$ (6)	(7)
100	6·845	·6998	183·752	67·406	12·323	100
101	·850	·7079	183·092	66·956	12·200	101
102	·855	·7161	182·433	66·507	12·078	102
103	·860	·7244	181·774	66·061	11·957	103
104	·865	·7328	181·115	65·616	11·837	104
105	·870	·7413	180·456	65·173	11·718	105
106	·875	·7499	179·797	64·731	11·600	106
107	·880	·7586	179·139	64·292	11·483	107
108	·885	·7674	178·481	63·854	11·366	108
109	·890	·7762	177·824	63·418	11·251	109
110	·895	·7852	177·167	62·984	11·137	110
111	·900	·7943	176·510	62·552	11·024	111
112	·905	·8035	175·853	62·122	10·912	112
113	·910	·8128	175·197	61·693	10·802	113
114	·915	·8222	174·541	61·266	10·692	114
115	·920	·8318	173·886	60·840	10·583	115
116	·925	·8414	173·231	60·417	10·473	116
117	·930	·8511	172·576	59·995	10·366	117
118	·935	·8610	171·922	59·576	10·260	118
119	·940	·8710	171·268	59·158	10·155	119
120	·945	·8810	170·514	58·742	10·051	120
121	·950	·8913	169·961	58·328	9·948	121
122	·955	·9016	169·309	57·915	9·846	122
123	·960	·9120	168·656	57·504	9·745	123
124	·965	·9226	168·004	57·096	9·645	124
125	·970	·9333	167·353	56·689	9·546	125
126	·975	·9441	166·702	56·284	9·448	126
127	·980	·9550	166·051	55·880	9·350	127
128	·985	·9661	165·401	55·479	9·254	128
129	·990	·9772	164·752	55·079	9·159	129
130	·995	·9886	164·102	54·681	9·064	130
131	5·000	1·000	163·454	54·285	8·970	131
132	·005	1·012	162·805	53·891	8·878	132
133	·010	1·023	162·158	53·499	8·786	133
134	·015	1·035	161·510	53·109	8·695	134
135	·020	1·047	160·864	52·720	8·605	135
136	·025	1·059	160·218	52·333	8·515	136
137	·030	1·072	159·572	51·949	8·427	137
138	·035	1·084	158·927	51·566	8·340	138
139	·040	1·096	158·282	51·185	8·253	139
140	·045	1·109	157·638	50·805	8·167	140
141	·050	1·122	156·995	50·428	8·079	141
142	·055	1·135	156·352	50·052	7·994	142
143	·060	1·148	155·709	49·679	7·911	143
144	·065	1·161	155·068	49·307	7·828	144
145	·070	1·175	154·426	48·937	7·746	145
146	·075	1·189	153·786	48·569	7·665	146
147	·080	1·202	153·146	48·202	7·584	147
148	·085	1·216	152·506	47·838	7·504	148
149	·090	1·230	151·868	47·475	7·426	149

TABLE NO. IV—continued.

$\mu'_{n+t} = A + Bc^{n+t}$ $A = 00115125$ for interval $\tau$						
$t$	$\log(\mu'_t - A)$ for interval $\tau$	$100,000$ $\times(\mu'_t - A)$	VALUES OF COMPLETE EXPECTATIONS IN TERMS OF UNIT OF TIME $\tau = \frac{1}{e_{n+t}}$			$t$
		$B'c^t$	$n=400$	$n=600$	$n=800$	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
150	5.095	1.245	151.229	47.115	7.347	150
151	.100	1.259	150.592	46.756	7.270	151
152	.105	1.274	149.955	46.399	7.193	152
153	.110	1.288	149.319	46.044	7.117	153
154	.115	1.303	148.683	45.690	7.042	154
155	.120	1.318	148.049	45.339	6.968	155
156	.125	1.334	147.414	44.989	6.894	156
157	.130	1.349	146.781	44.642	6.821	157
158	.135	1.365	146.148	44.296	6.749	158
159	.140	1.380	145.516	43.952	6.677	159
160	.145	1.396	144.885	43.609	6.606	160
161	.150	1.413	144.254	43.269	6.536	161
162	.155	1.429	143.624	42.931	6.467	162
163	.160	1.445	142.995	42.594	6.398	163
164	.165	1.462	142.466	42.259	6.330	164
165	.170	1.479	141.839	41.926	6.263	165
166	.175	1.496	141.212	41.595	6.196	166
167	.180	1.514	140.586	41.266	6.130	167
168	.185	1.531	139.960	40.939	6.065	168
169	.190	1.549	139.336	40.613	6.000	169
170	.195	1.567	138.712	40.289	5.936	170
171	.200	1.585	138.089	39.967	5.872	171
172	.205	1.603	137.467	39.647	5.809	172
173	.210	1.622	136.845	39.319	5.747	173
174	.215	1.641	136.225	39.013	5.686	174
175	.220	1.660	135.605	38.698	5.625	175
176	.225	1.679	134.986	38.385	5.565	176
177	.230	1.698	134.369	38.074	5.505	177
178	.235	1.718	133.751	37.765	5.446	178
179	.240	1.738	133.135	37.458	5.387	179
180	.245	1.758	132.520	37.153	5.329	180
181	.250	1.778	131.905	36.849	5.272	181
182	.255	1.799	131.292	36.547	5.215	182
183	.260	1.820	130.679	36.247	5.159	183
184	.265	1.841	129.967	35.949	5.103	184
185	.270	1.862	129.357	35.653	5.048	185
186	.275	1.884	128.747	35.358	4.994	186
187	.280	1.906	128.138	35.065	4.940	187
188	.285	1.928	127.530	34.774	4.887	188
189	.290	1.950	126.923	34.485	4.834	189
190	.295	1.972	126.317	33.346	4.781	190
191	.300	1.995	125.712	33.066	4.739	191
192	.305	2.018	125.107	34.198	4.678	192
193	.310	2.042	124.504	33.912	4.628	193
194	.315	2.065	123.902	33.628	4.578	194
195	.320	2.089	123.301	32.788	4.528	195
196	.325	2.113	122.701	32.511	4.479	196
197	.330	2.138	122.102	32.236	4.430	197
198	.335	2.163	121.504	31.963	4.382	198
199	.340	2.188	120.907	31.691	4.334	199



TABLE No. V.

*Application of Makeham's Formula to the Institute Healthy Females (HF) Table, based upon an Approximate Method of finding the Value of  $c$  from the original Exposed to Risk and Deaths.*

Log  $c$  found from drawing approximate curves through both items.

ORIGINAL FACTS			METHOD A.—log $c^5 = \cdot 2101$						METHOD B.—log $c^5 = \cdot 2181$					
Groups of Ages	Actual Deaths	Expected Deviation	Expected Deaths	Deviation for One Year of Age	Error	Accumulated Error	Double Accumulated Error	Expected Deaths	Deviation for one Year of Age	Error	Accumulated Error	Double Accumulated Error	Expected Deaths	Deviation for one Year of Age
0-4	2	1	+1	0	+1	+1	+1	3	0	+1	+1	+1	3	0
5-9	3	1	+1	0	4	5	6	7	0	4	5	6	7	0
10-14	7	2	+2	0	7	12	18	15	0	8	13	19	15	0
15-19	20	4	+4	0	5	17	35	26	0	6	19	38	26	0
20-24	43	5	+3	0	5	22	57	50	0	7	26	64	50	0
25-29	107	8	-1	1	...	4	61	92	1	...	11	75	92	1
30-34	150	9	-5	2	...	...	52	139	1	11	...	75	139	1
35-39	196	11	-7	3	...	...	26	181	3	...	...	60	181	3
40-44	229	12	-7	5	...	...	...	218	5	...	...	34	218	5
45-49	248	12	-1	9	3	...	...	249	8	1	...	9	249	8
50-54	272	13	+3	14	27	...	...	294	13	22	...	27	294	13
55-59	317	14	+3	20	31	24	...	341	19	24	21	6	341	19
60-64	373	15	+2	27	19	43	15	385	26	12	33	27	385	26
65-69	410	16	+3	32	...	35	...	397	31	...	...	60	397	31
70-74	400	15	-1	388	...	32	53	369	31	...	20	80	369	31
75-79	318	14	-1	282	36	3	20	287	26	...	...	69	287	26
80-84	147	9	-4	172	...	...	12	177	17	30	...	15	177	17
85-89	77	7	+4	76	1	...	3	78	8	...	...	4	78	8
90-94	11	3	...	17	6	...	...	18	2	7	...	...	18	2
95-end	5	2	+1	8	3	...	...	9	1	4	...	...	...	1
Total	3,335	$\pm 173$	$+27$	3,335	136	166	409	3,335	192	127	149	669	3,335	192

100A = .9203  
10,000B = .5036

100A = .9574  
10,000B = .3826



TABLE NO. VII.  
*Result of Graduation by Method A re-stated, giving effect to Minimum Modifications and showing  
 Graduated Intervals of Age, and thereby  $\cdot 2101 = \log e^{4.86}$ .*

AGES OF THE LIVES OBSERVED				DEATHS		DEVIATIONS			ERRORS AND SUMS OF ERRORS AFTER GIVING EFFECT TO MODIFICATIONS IN COL. 9 BY ADDITION TO ACTUAL DEATHS			
Group of Five Ages	Mean Age of Group	Graduated Mean Age	Deviation	Actual	Expected (Un- modified)	Expected	For One Year of Age	Minimum Modifi- cation to Actual Deaths	Error	First Summation	Second Summation	Third Summation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
0-4	2.51	2.36	-.15	2	3	±	0	+1	+	+	+	+
5-9	7.37	7.32	.05	3	7	1	0	+1	...	...	...	...
10-14	12.21	12.28	-.07	7	14	2	0	+2	...	...	...	...
15-19	17.30	17.24	.06	20	25	4	0	+4	...	...	...	...
20-24	22.24	22.20	.04	43	48	5	0	+3	...	...	...	...
25-29	27.20	27.16	.04	107	89	8	1	-1	...	...	...	...
30-34	32.10	32.12	.02	150	137	9	2	-5	17	...	...	...
35-39	37.06	37.08	.02	196	179	11	3	-7	8	...	...	...
40-44	42.02	42.04	.02	229	218	12	5	-7	10	...	...	...
45-49	46.99	47.00	.01	248	251	12	9	-1	...	...	...	...
50-54	51.97	51.96	.01	272	299	13	14	+3	...	...	...	...
55-59	56.95	56.92	.03	317	348	14	20	+3	24	...	...	...
60-64	61.89	61.88	.01	373	392	15	27	+2	28	...	...	...
65-69	66.83	66.84	.01	400	402	16	32	+3	17	...	...	...
70-74	71.79	71.80	.01	410	368	15	32	-1	...	...	...	...
75-79	76.67	76.76	.09	318	282	14	26	-1	...	...	...	...
80-84	81.64	81.72	.08	147	172	9	16	-4	...	...	...	...
85-89	86.31	86.68	.37	77	76	7	7	+4	...	...	...	...
90-94	91.48	91.64	.16	11	17	3	2	+1	...	...	...	...
95-end	95.87	96.60	.73	5	8	2	1	±	...	...	...	...
			+	3,335	3,335	±	197	±	121	141	221	442
			-	0.39		173		27	121	141	221	442

## DISCUSSION.

The PRESIDENT congratulated the author upon having submitted a paper which seemed to have very large possibilities. Mr. Calderon had been for some time associated with Mr. Ackland in the collation of that large new experience which was now coming happily to a close. He believed he was correct in saying that the idea of the paper arose out of some calculations which the author had been making for Mr. George Hardy in connection with the graduation of the new annuity experience. He was sorry to say that his knowledge of the differential calculus was so extremely rusty that he had been unable to follow the paper very closely, but he could conceive that a great step in advance would certainly be made if it were possible to use some mechanical contrivance of the kind shown them by the author, or a series of curves drawn to various values of logarithm  $c$ , engraved, as the author suggested, upon a sheet of glass. That would assist very much in determining the constants for the graduation of any unadjusted series they might wish to operate upon. It would then apparently be only necessary to draw a diagram upon paper ruled to the same scale for which that mechanical apparatus or series of curves was designed, and place it under the mechanical device to see which curve best suited those unadjusted values. One point in the paper which struck him as useful, and which was a method which he himself had used, was not only to draw a diagram representing the unadjusted data, but also to draw on either side of it other lines representing the probable errors. By that means they were able to judge a little better whether the graduated results came fairly within the range of probabilities.

Mr. G. F. HARDY said it was their duty to welcome, as the Institute always did, a new contributor to its transactions, especially when he produced a paper showing evidence of so much work and so much ingenuity. The present paper consisted in the main of a description of certain model mortality tables, as they might be termed, based upon Makeham's formula, and of certain methods of obtaining the constants in Makeham's formula for the Force of Mortality directly from the table of "Exposed to Risk" and "Died", one of these methods, a very ingenious one, being a graphic or mechanical method.

The mortality tables which Mr. Calderon had produced might be best described as Generalized Mortality Tables, or Generalized Makeham Graduations. The principle of the tables would be readily understood by those who were familiar with Mr. Makeham's Table of Continuous Annuities in the *Journal*,\* where from a single table could be obtained the values of annuities for all rates of interest and all durations. Some additional explanation by the author in respect to these tables might be of advantage, as *e.g.*, why they started at particular initial values of the arguments. He thought it would be worth while to consider whether the logarithms of the continuous expectation rather than the expectations themselves, which in some cases involved large factors, might not be used.

On various occasions he had personally made use of Model

\* *J.I.A.*, xv, 432.

Makeham tables, but he had never attempted to include in one single table, as Mr. Calderon had done, all possible Makeham graduations, having used a series of tables with selected values of the constant  $c$ . Whether an advantage arising from the greater generality of the table given in the paper was not to some extent counter-balanced by the additional labour of interpolations dealing with a whole series of fractional ages he could not say without a practical trial of both systems. As to the methods for obtaining the constants, he thought Mr. Calderon's method of obtaining the value of the constant  $c$  direct from the numbers of the Exposed to Risk and Deaths by representing these numbers by the terms of a binomial expansion particularly ingenious. The author had given four methods in all—A, B, C, and D, a common principle underlying all of them, namely, the representation of the Exposed to Risk by a "binomial" curve. Of the four methods, Method C seemed to him for various reasons the most advantageous. In Method A, for example, they had a graduation which followed Gompertz's law and not Makeham's. There might be occasions, of course, when they would wish to use Gompertz's graduation for certain tables, *e.g.*, a Female Annuitant Table, beyond age fifty or fifty-five, might be very well graduated in that way, but for ordinary purposes they required to take account of the constant part of the Force of Mortality, so that Method A was of only limited application.

The principle which Mr. Calderon had followed in making the summations of the deviations vanish he had found of great convenience in practice. The merit of it, he thought, really belonged to Professor Karl Pearson, as, although not the same process, it was identical in principle with the method of moments employed by him in fitting frequency curves to series of observations, in which each ordinate was multiplied by the successive powers of its abscissa (it was of no consequence where the origin was taken), and the adjusted and unadjusted summations made to accord. That, of course, was the same thing as making successive summations of the deviations disappear. The only doubt as to the principle which occurred to him was whether the weights attached to the observations should be uniform throughout the series or not. He thought that Mr. Calderon had hardly done justice to his method of obtaining the constants in having fixed for purposes of illustration upon a table like the  $H^F$ , which was not at all suitable to a graduation by Makeham, and having endeavoured to bring down his graduation to age 0. The result was that a portion of the experience which was manifestly in divergence with the general law was brought in, and no doubt prevented that closer agreement in other parts of the table which might otherwise have been obtained. He thought it would be worth while to cut out the earlier ages—say, up to age twenty—and to deal with that portion of the table (or that portion of some other table perhaps more closely following Makeham's law than the  $H^F$  Table), which represented the mortality of adult life only, which past experience showed could be fairly well represented by Makeham's formula. There would be some difficulty in the case of a curve starting suddenly at an age such as twenty or twenty-five in representing it by a binomial expansion, but there



would be no objection, especially in using Method C, to the terms of the substituted binomial series being considerably smaller at the initial ages than in the original table, as they would thereby be merely giving less weight to those ages to which it was most doubtful whether the Makeham law was applicable, and a greater weight to that part of the table to which they knew from previous experience the law did apply. Although one was reluctant to suggest any more work on a paper which represented so much labour as the one under discussion, he thought it would certainly be worth while to try how close an agreement with the original facts would be obtained by Method C with a table such as the  $H^M$  over age 25.

There was no reference in the paper to any previous methods of obtaining the Makeham constants, and he thought perhaps some reference might be useful, particularly to such a method as that explained by Mr. Makeham in his paper on the Graduation of a Limited Experience. That paper had always seemed to him a very elegant one, and although Mr. Makeham illustrated his principle by application to a very limited experience indeed, the method was equally applicable, however large the experience might be. That method, as would be remembered, was based on the assumption that  $\log c$  was equal to  $\cdot 04$ , but having found that this was an average value of  $\log c$ , which was not greatly deviated from, the method might be readily extended so as to embrace a correction of the assumed value of  $\log c$ . They could then obtain all three constants direct from the observations, and might, of course, employ the method of successive summations of the deaths instead of using arbitrary sections of the experience. The probable error curve, by means of which Mr. Calderon represented the unadjusted values as a sort of river instead of a single line, was a useful suggestion for graphically graduating a series of observations. The great danger in graphic graduation was that they had not constantly before them in different parts of the curve any guide as to the extent to which they were justified in departing from the original facts in drawing their graduated curve. This method provided them with such a guide, in the form of limiting curves, between which, on the whole, the graduated curve should lie. With respect to the computed values of the probable errors, he did not entirely agree with the whole of the mathematics there. There was an objection to the solution of the inverse problem of probabilities which depended upon the assumption that all values of the probability sought were *a priori* equally probable, because, when applied to a question like that of determining rates of mortality, they knew the initial assumption was not correct, all values not being equally probable. Where the observations were very numerous, the error introduced would not be of very great moment, but it was clear that if the principle of that formula were correct, they would have to deduce from their exposed to risk and deaths a different value for the rate of mortality than that which they were, rightly, in the habit of using at the present time. Coming now to the mechanical and graphic methods that Mr. Calderon had employed, the machine exhibited was certainly an ingenious one, but the author himself had pointed out certain

difficulties in operating the machine in practice. He thought the series of curves which the author had drawn on tracing paper more practicable, as it would be comparatively simple to place the Makeham curves over the rough curves of  $\mu_x$  or  $\text{colog } p_x$ , and move it about until they were satisfied they had a sufficiently close agreement. The value of the suggestion would be more obvious to students of the paper, and to those who might hereafter wish to make use of the method, if they could have traced on the diagram, say in red ink, the unadjusted values of  $\text{colog } p_x$  of the  $H^M$  or some other such table, with a sufficient explanation of the process to show how from a comparison of the unadjusted and adjusted curves the values of  $\log c$  and of the other constants could be obtained. The insufficiency of the scale, and the difficulty of very exactly reading off values, would make the results approximate only, though probably sufficiently so for many purposes. Although a great many points might require further discussion, or even criticism, he thought that Mr. Calderon had given them a very interesting paper, and one that would repay close attention and study.

Mr. J. BURN took it that the main object of the paper was the formation of hypothetical tables of  $\mu_x$ , which would be useful in graduating any mortality experience. He thought the idea of these tables might, perhaps, be better understood by fixing their attention on the exact meaning of  $\mu_x$ . The force of mortality was the rate per unit per annum, at the exact age  $x$ , and, therefore, if it were usual to measure ages in months, they would have the exact force of mortality at age 240 months the same as at age 20 years. If they made their unit of measurement a month they would have  $12 \mu'_{240} = \mu_{20}$ . Mr. Calderon had made use of that principle in order to help them by means of his Tables I and II to find equidistant values of  $\mu$  for any new mortality experience which they might wish to graduate. The way in which that was to be accomplished was explained on page 159; there  $\log c' = .005$ ; therefore, the actual value of  $c'$  was 1.0115. In the example given on page 160

$$\begin{aligned}\log c &= .038, \text{ therefore} \\ c &= 1.0914.\end{aligned}$$

The necessary interval, therefore, in Mr. Calderon's table would be that power of  $c'$  which would give the value 1.0914. That, of course, was found by dividing .038 by .005. That was, the intervals in the hypothetical tables were such that it would take 7.6 of that to give an increase in  $\mu_x$ , equal to the increase of one year in their normal table. Thus in the same way that the force of mortality, if measured in months, had to be multiplied by 12 in order to obtain the corresponding force for a year, so here they had to multiply the force of mortality in the hypothetical table by 7.6. Having obtained one value in the hypothetical table, their next required value would be between the 7th and 8th, the next value would be between the 15th and 16th, and so on. In fact, by referring to Mr. Calderon's own example, it would be seen that, having obtained  $\mu_0$ , they could not get another exact value before  $\mu_{25}$ . Therefore, of course, it became necessary to interpolate for the remaining values. He (Mr. Burn) could not help feeling that Mr. Calderon's method would

involve very considerable labour. It would appear that in all cases it would first be necessary to calculate the ungraduated values of  $\mu_x$ , and presumably set these values out graphically. It would next be necessary to decide what value of  $A$  would be most suitable; then, having found the value of " $c$ ", they could proceed to fix on some value in Mr. Calderon's table for their initial  $\mu_x$ . All this would involve considerable labour, but even then they could seldom expect to obtain more than four or five values from Mr. Calderon's tables, after which all the remaining values were to be approximately obtained by some method of interpolation. Granting the very ingenious nature of Mr. Calderon's suggestions, he found it difficult to imagine any advantage to be obtained over a straightforward calculation by means of the formula

$$\mu_x = A + Bc^x.$$

Mr. Calderon had invented a mechanical contrivance which might be found useful in ascertaining the value of " $c$ " to be used in the graduation of any mortality experience, but he (Mr. Burn) believed that it had generally been found that the value of this quantity varied within very narrow limits, and, therefore, in most cases its exact value was comparatively unimportant. Mr. Calderon had formed his tables with various values for the constants; he had not mentioned what led him to adopt those values, and he (Mr. Burn) had taken some trouble in endeavouring to trace some reason for the particular values adopted, but he had only succeeded in obtaining the following relationships, viz.:—

$$\begin{aligned}\log_{10} (1 + A_1) &= \cdot 0001 \\ \log_{10} (1 + A_2) &= \cdot 0002 \\ \log_{10} (1 + A_3) &= \cdot 0003 \\ \log_{10} (1 + A_4) &= \cdot 0004 \\ \log_{10} (1 + A_5) &= \cdot 0005 \\ c &= (1 + A_1)^{50} \\ c^2 &= (1 + A_2)^{50} \\ c^3 &= (1 + A_3)^{50} \\ B &= \cdot 0000022909\end{aligned}$$

He thought that some explanation of these relationships would be interesting. Turning to Method A on page 163, that was to be looked at in conjunction with Diagram 1. Mr. Calderon had conceived the idea of graduating the exposed to risk and deaths separately. The first graduation was effected by means of a binomial expansion. The principal feature to be noticed in the diagrams resulting from these expansions was that the mode or height of the curves varied considerably. These binomial curves, however, appeared to have been merely used as a preliminary to the second curve shown in the diagram. In considering those curves it was to be remembered that if the rates of mortality were constant for all ages, then the curve representing the deaths would exactly coincide with the curve representing the exposed to risk. But since the rate of mortality was in increasing progression the maximum point in the deaths occurred at a later age than in the exposed to risk. On page 162, Mr. Calderon mentioned that if he took an experience which, instead of starting

with the original date of the policy, commenced at some even calendar date, then the distance between the maximum point in that death curve and the maximum point in the exposed to risk curve would be still further increased. He (Mr. Burn) was unable to follow that point. He should have thought at first reading that the result of thus excluding the effect of selection would have been in the opposite direction to that which Mr. Calderon had pointed out. In the binomial expansion, Mr. Calderon took  $a + \beta$  for the deaths where

$$a = \frac{a}{a + bc} \text{ and } \beta = \frac{bc}{a + bc}.$$

He was unable to see why Mr. Calderon had adopted that particular form, and he thought it would be rather interesting to know how it arose. Mr. Calderon had suggested other methods of graduation, namely, B, C and D, but he appeared to have given more particular prominence to Method A. In Table VII, the author again presented the results of Method A, and in that table he gave what he called minimum modifications of the actual deaths. He was unable to see exactly how those figures were arrived at. They seemed to be altogether arbitrary, but it would be seen that by means of those modifications exact results were obtained in the second and third summations. Whether that necessarily showed that the graduation was better, seemed rather difficult to follow. Mr. Calderon in all his methods had boldly attempted to graduate the whole of the mortality table from age 0 to the extreme age by means of a single formula. If they looked at the results, he did not think that they could consider them entirely satisfactory. Examine the actual and expected deaths, taking the groups 0 to 19 in any of the tables, and it would be found that the actual deaths were 32 and the expected deaths in Table V, Method A, 49; Method B, 51; Table VI, Method A, 54; Method B, 54. Even in Table VII, where the minimum modifications had been added, the number of deaths was 49. Thus the expected deaths in each case were over 50 per-cent in excess of the actual deaths, and it would be noticed that those deaths which had been added at the younger ages were taken off at the latter portion of the table. Mr. Calderon's method of graduation was, of course, based on the idea that the Exposures and Deaths could be represented by symmetrical figures. He (Mr. Burn) was not able to say whether that was possible, but experience would seem to lead them to choose about age thirty as the initial age, and a glance at the diagram would show that symmetry would compel them to stop at about age sixty. It also occurred to him that, although in the experience chosen, the Exposed to Risk curve was fairly symmetrical, yet he should imagine that it would be found in other experiences the form of the curve would be largely influenced by the average duration of the policies and by the number of endowment assurances which were included. If the offices were doing a large number of endowment assurances, the probability was that the number of Exposures would become very limited after the age at which the majority of the endowments matured. Mr. Calderon had considered three unknown quantities, namely, A, B,  $c$ , as involved in Mr. Makeham's formula; but he (Mr. Burn) thought that there was a fourth quantity which Mr. Calderon had



overlooked, and that was "the range of the table over which Makeham could be successfully applied."

The CHAIRMAN said he would ask Mr. Calderon to be good enough to reply, but before doing so he would ask the members to pass a cordial vote of thanks to him for his able and interesting paper.

The resolution was carried by acclamation.

Mr. CALDERON, in reply, said that Mr. Hardy had referred to the difficulty of ascertaining the basis on which he had found his constants for the tables. The method he had adopted was really simple. He began Tables I and II at the end—at age  $\omega$  where  $p_x$  was made equal to  $\frac{1}{2}$  and worked backwards as far as practicable. The reason why Tables III and IV began with  $-3$  was, he was afraid, the result of indolence. He had prepared his papers in the form in which he intended to use them when he suddenly discovered that one table went one term beyond the others, and instead of re-writing them he had put the negative index in. That would probably explain what was, perhaps, not quite apparent in the table. Mr. Hardy suggested that the log of the expectation might be given in the value. Did that apply to the expectation or to the value of the  $\mu$  or both?

Mr. HARDY said it applied to the expectation; so that one could at once get at the ratios.

Mr. CALDERON said that if the tables had been got out in the way suggested by Mr. Hardy, namely, for different values of  $c$ , there would certainly be less difficulty in interpolating between the values, but more tables would be required. He had tried to get a generalized mortality table by which it would be possible to get the values of complicated or other benefits, and which would therefore save a great deal of trouble, since they would not have to be re-calculated every time except by multiplication. It was with that view that he thought it worth while putting the present tables forward as a first instalment of an attempt in that direction. With regard to the graduation of the  $H^F$  Table, both Mr. Hardy and Mr. Burn had remarked that he had made this graduation one for the whole of the mortality table when he might much better have begun at age twenty or thirty; and, further, that he might have taken a table other than the  $H^F$ . His first object was to take purposely a small table. For one thing, there was less mathematical work in the second and third summations. The second point was that he thought it might be of interest to see how far a Makeham curve would apply to female lives. In the third place, he had not then discovered where the facts were given for what would, perhaps, have been a preferable subject, namely, the  $H^{M(5)}$  Table, which were the actual exposed to risk and deaths given by Dr. Sprague in one of his papers, and he would have been happy to work a table on that basis, although the work would have been rather heavier. Of course, the problem which he had set himself was a mathematical one, not physiological or sociological, and therefore he had taken the  $H^F$  Table, and in order to show the full effects of the methods he had used the exposed to risk right the way back to age 0, although if he were undertaking a finished graduation he would no doubt do as Mr. Hardy and Mr. Burn suggested, namely, begin at a later age. It was with the object of illustrating certain points,



rather than of completing, at this stage of the proceedings, the  $H^F$  Table, which might, or might not be, displaced at no very distant date, that he thought it worth while presenting the results in that form. The difficulty which he did find was that in order to get the Exposed to Risk into a binomial curve he had, as Mr. Hardy surmised, felt obliged to take in the whole of the data, since by beginning at a later age, and hence with a large number of exposed, the form of the curve was less applicable. That might be got over by including the first ten ages of the experience in different proportions, and shading the table off, say, taking one-tenth of the exposed, at age 15, and so on, and artificially fixing in an artificial tail. Such would be an artificial method, but if one intended to balance one's table afterwards in finding the remaining constants no great harm would ensue. He was not quite sure whether he quite followed Mr. Hardy in regard to the idea of tilting the curve. He, himself, had had to abandon the idea that they could, by transferring the co-ordinates and altering their direction, get a new value; but they would get Makeham's second constant if they kept one of the axes in the same position, and altered the axis of  $x$  only. But if they put the curve in a position like that, they could not read off the curve with which it corresponded. He had at one time hoped that it was possible to do it in that way, but when they came to transform the co-ordinates the formula was so involved that it was impossible to extricate the values. If they tilted their curve it was necessary to tilt one of the axes, but the other should be retained in the same position. As to his method of computing the probable error, using the exploded doctrine of Laplace on the subject, he was conscious of that difficulty, but he considered that in using the formula in the way he had done (which curiously enough reproduced itself), by applying it to an infinite number of observations, it was satisfactory. He thought it would be found that the real difficulty about Laplace's method was when it was applied to a limited number of future observations, whereas if it were applied to an unlimited number of observations the difficulty was got over. His results seemed to resemble very closely those given by other methods of probable error. With regard to the Tables I to IV, Mr. Burn objected to the form in which he (the author) had given them, because there would be a great deal of difficulty in interpolating for every value of  $\mu$ , and also for every value of  $e$ , in preparing a table with which it was intended to make comparison of the ungraduated functions. He presumed that if one were graduating a table one would be content to obtain quinquennial values, and then a great deal of the trouble which Mr. Burn had foreshadowed would to a certain extent disappear. Mr. Burn had also referred to the statement in the paper that the curves would agree very much better in any experience which was started, not from the beginning of each assurance, but from a later date in their experience. The reason of that was simply that it meant a thinning down of the experience at the younger ages necessarily since the observation at the younger years of life was excluded from each of the assurances, and consequently there was proportionate swelling of the data towards the centre of the table. Mr. Burn could not understand why  $\alpha$  and  $\beta$  were taken

as respectively equal to values given on page 163. The values were not necessarily equal to any given values, but they were assumed as equal to them, this being the form required in order to get their values under the conditions imposed. In the first place, instead of the form  $(a + \beta)^n$ , he wanted to obtain the values in the form of  $(aa + bc)^n$ . This expression, however, was necessarily not equal to unity, and in order to make the whole summation equal to unity one had to divide all through by  $(a + bc)^n$ . He thanked the members for their patient attention to a subject which he was afraid he had not dealt with very well.

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*On Surrender-Values and the Principles which underlie their Calculation.* By FREDERICK WESLEY FULFORD, F.I.A., of the Prudential Assurance Company.

[Read before the Institute, 26 February 1900.]

THE President in his inaugural address last session, expressed the opinion that "the time is ripe for another discussion on surrender-values." In accordance with that suggestion, I have ventured to bring to your notice some considerations bearing on the subject of surrender-values and the principles which, it would appear, should underlie their calculation.

It was with much diffidence that I started upon the preparation of this paper, knowing that there are many far more experienced and better able to deal with the subject than I. But I have been encouraged in the task by the further remarks of the President that "we assemble here to discuss any question that has any connection with the profession of actuary, with the laudable object of imparting and receiving knowledge and instruction", and that it is not necessary to wait until some "ponderous essay" or "wonderful discovery" can be produced before taking part in the proceedings of this Institute.

That the question as to the proper surrender-value to be allowed is a controversial one, I am fully aware, and in order to anticipate certain criticisms which may be passed on the method of calculating surrender-values to which I have the honour to call attention this evening, I may add that it is not put forward as the only method, or as invariable, but rather as affording an opportunity for the discussion of the general question. The fruit of such discussion cannot fail to be of the utmost value, especially to those younger members of the profession who may not have been in a position to consider the question in all its bearings.

The subject is one with which we are brought into daily contact in the course of our business. We are constantly called upon to point out to the assured that the premiums paid on a life policy are not like deposits paid into a bank, and to explain what a surrender-value is, and how it arises. The principles of life assurance are, however, somewhat beyond the ken of the general body of policyholders, and it is very seldom that a policyholder takes the surrender-value without feeling that the company has made a very good thing out of the transaction.

We have not had a sitting devoted to this question since Mr. Crisford's able and exhaustive Prize Essay\* was read over twenty years ago. Since that time life assurance has undergone considerable changes. The enormous growth of Endowment Assurances which has taken place, and which is still going on, could not have been predicted. Assurances of this kind used to be looked on as belonging to a special class, whereas now they probably form a large proportion of the new business issued by most companies. With regard to the expenses of the business of life assurance, it seems to be the common opinion that these have increased, although I am not aware that any actual proof that this is the case appears in our records. I have recently had access to the results of an investigation into the expenses of 39 British life offices since the passing of the Life Assurance Companies Act. The offices selected were those which have been in existence since 1870 and which have been conducted on ordinary lines. All those offices having any peculiar feature in their constitution likely to influence the expenses were excluded. Thus, companies not paying commission, or restricting the expenses to a fixed percentage of the premiums, were omitted, as were also those transacting industrial business. Table A gives these results :

TABLE A.—*Percentage of Expenses to Premiums received.*  
As shown by the Board of Trade Returns made by 39 Companies from the date of the passing of the Life Assurance Companies Act.

Period	Commission	Expenses of Management	Total Expenses	Period
1870-74	4.38	8.71	13.09	1870-74
1875-79	4.53	9.12	13.65	1875-79
1880-84	4.67	9.69	14.36	1880-84
1885-89	4.86	10.20	15.06	1885-89
1890-94	5.47	10.28	15.75	1890-94
1895-97	5.74	9.61	15.35	1895-97

\* *J.I.A.*, vol. xxi., page 301.

An inspection of this table shows that the rate of expenditure, both in respect of commission and management, has steadily increased up to 1894, but in the period 1895—97 there appears to be a falling-off in the management expenses. This falling-off, however, is more apparent than real, and may probably be partly due to the fact that, the period to which the expenses relate being only three years, the valuation expenses in some cases have not been included.

The large amount paid by offices each year on account of surrenders, emphasizes the importance of the subject of surrender-values both to the offices and to the large body of insured lives, and shows to what extent the offices have to be prepared to meet calls upon the funds practically payable on demand.

An examination of the accounts of 72 British life offices shows that the following amounts were paid in surrender-values during the five years ending December 1897.

1893	.	.	.	1,007,782
1894	.	.	.	1,041,834
1895	.	.	.	1,010,803
1896	.	.	.	1,020,621
1897	.	.	.	947,577
Total				<u>5,028,617</u>

Having regard to the altered conditions and modern developments of life assurance, and to the time that has elapsed since the subject of surrender-values was last under the consideration of the Institute, it would seem that further discussion would be profitable, at the present time, especially as to the way in which endowment assurances should be treated.

The right of a withdrawing policyholder to have returned to him any portion of the premiums he has paid has sometimes been disputed, but either as a result of competition, or as a recognition of the equities of the case, most, if not all, offices conducted on the level premium system, allow a surrender-value after a certain number of premiums have been paid.

The question of the legal right of a policyholder to a surrender-value, has fortunately not yet been the subject of any formal decision in this country; but there can be no reasonable doubt that, legally, he has no claim against the office, seeing that the contract of life assurance does not contemplate surrender, except perhaps so far as the minimum surrender-value mentioned in the prospectuses of most companies is concerned.

We are not like some of our unfortunate cousins in America,



trammelled by "ironclad statutes", which compel the allowance of fixed surrender-values to defaulting policyholders, without regard to the interests of those whom one would have thought far more deserving of consideration, namely, the persistent policyholders. And so long as British offices continue to conduct their business with due regard to the interests of all parties, they will, I believe, have little to fear from legislative interference. One of the most flagrant instances of the evils of State control, is that furnished by the case of the Massachusetts companies. These companies are compelled by law to allow cash surrender-values, after two full years' premiums have been paid, on the following basis. The full reserve according to the legal standard must be allowed as surrender-value, less a surrender-charge of eight per-cent of what is termed the insurance-value, or present value of the future contributions to mortality that the policy would be exposed to pay in the event of its continuance. This method provides a fairly equitable surrender-charge in the case of whole life policies, but for endowment assurances, except at the long terms, it entirely fails in its object. In endowment assurances, as is well known, the mortality risk rapidly diminishes with the duration of assurance. Consequently the surrender-charges brought out by the above method are ridiculously small and totally inadequate to compensate the office for the expenses incurred.

The law relating to surrender-values above referred to was enacted in 1880, and applies only to the Massachusetts companies, leaving their rivals, both in Massachusetts and in other States "wholly untrammelled."

Some years after the enactment of this law, the State apparently recognized that it worked unfairly in the case of endowment assurances, and some attempt was made to relieve the hardship under which the Massachusetts companies laboured. In 1887 a law was passed authorizing the companies to make a further deduction of 5 per-cent of the reserve from the surrender-values of endowment assurances, when taken in cash, but not if taken in paid-up policy. The companies, however, endeavoured to do without the benefit of this concession for some time, but ultimately decided they could do so no longer, and that all policies issued from the 1st January 1896 should be subject to the law of 1887. But the Legislature again exercised its prerogative in 1896 and repealed the concession. The companies then resolved to discontinue the issue of endowment assurances as far as possible,



until some improvement in the law could be obtained. I should like here to acknowledge the kindness and courtesy of Mr. Fredk. L. Cutting, Insurance Commissioner of Massachusetts, to whom I am indebted for interesting information\* regarding the working of the law of that State on surrender-values.

To return to the question of the right of the policyholder to a surrender-value. It would, I think, be a dangerous course to encourage the idea that a policyholder has any individual rights in the reserve against his policy. Individually, life assurance is an impossibility. An individual can only obtain it in conjunction with a number of others sufficiently numerous to admit of reliable estimates being made as regards the future mortality likely to obtain among the whole body. In equity, however, it will not be disputed that the policyholder is entitled to some return on withdrawal, providing he has paid more than is sufficient to compensate the office for the expenses and risk already run, for the selection he exercises against the office on withdrawal and for the loss of his future contributions to the general expenses of the society, which will in no way be materially reduced by his secession.

\* DEAR SIR,—I have just received your favour of the 19th ult. relating to the surrender-value provisions of the Massachusetts insurance laws, and their effect in restraining the companies to which they apply from prosecuting certain plans of the business.

In order to make the discussion more consecutive and complete, the comments in Report for 1897 to which you allude should be taken in sequence to those in report of next previous year, which I venture to forward by same mail.

It will be observed that this law applies only to companies incorporated in this State, leaving their rivals from other States wholly untrammelled, and this is the hardship complained of.

The five companies to which the law applies are the Berkshire, John Hancock Mutual, Massachusetts Mutual, New England Mutual, and the State Mutual.

The detailed exhibits of these companies, as appear in the Report of 1896, show that the first and third of them had in force a relatively small amount of endowment business; the second about an equal amount with life; while the last two pursued the endowment plan almost exclusively. When the 5 per-cent relief clause was repealed in 1896, all five of the companies decided to discontinue as far as possible the issue of this plan of business, and refrain from it until such time as relief could be attained through change of the statute. Any further motion for a change should properly come from the companies, as the Commissioner feels that, in his various reports to the Legislature, he has put the case as urgently as official propriety would justify.

The hint in 1896 Report, as to the fair basis of surrender-charge, was suggested by your Mr. Crisford's thesis to the Institute in 1872, I think. And opinion among the Massachusetts companies seem to be generally crystalizing to that theory, so that it is probable that a change, when one is made, will be urged along that line, although it must be said there are at the present time no indications of any early attempt at securing a modification of the statute.

Respectfully yours,

FREDK. L. CUTTING,

*Insurance Commissioner.*

Dr. Sprague, in his paper entitled "Some Remarks on the application of the Principle of Non-Forfeiture to Ordinary Policies" (*J.I.A.*, vol. xxiv, page 364), says:—"If we consider how the surrender-value of a policy arises, it must, I think, be admitted that justice requires that failure to pay the premium ought not to involve the forfeiture of the surrender-value. The assured pays into the office a sum larger than is required to meet the current risk and provide for expenses, and these over-payments are accumulated by the office in order to provide for the time when the sums paid by the assured will be insufficient to meet the current risk. The over-payments are thus virtually sums entrusted to the office, in order to be accumulated by it, for the benefit of the assured, and the accumulations of these give rise to the reserve held by the office in respect of the policy. That reserve is in no sense the property of the assured, but his rights in it are recognized by the almost universal allowance of a portion of it as a surrender-value of the policy."

The Insurance Commissioner of Massachusetts, Mr. G. H. Merrill, in his 1897 Report, sums up the position of the retiring policyholder as follows: "It should be distinctly understood and remembered that the principle of mutual insurance does not contemplate the retreat or defection of either party; the company cannot avoid the obligation, however desirable it might be from a pecuniary point to get rid of an impaired risk, and reciprocally the member should not be allowed to retire unless he leaves the continuing members a proper compensation for the loss by his delinquency. And if upon the retirement of a member he is required to make good (to those continuing) his promised and fairly-due share for his already incurred costs and for the future maintenance of the institution, he could then, without injury or loss to his fellow members, be permitted to withdraw and have applied to his own benefit—to his own purely personal account, any unused portion of his previous contributions which then remains, provided always, that such defections are not of sufficient number to disturb the general averages which are the essential and vital basis of all insurance."

These remarks were written with a mutual office in view, but they appear to apply equally well to a proprietary office, with this addition, that there is in the latter case, a further compensation due to the proprietors on account of the loss of their share in the

future profits, which might be looked for, if the policy were continued.

From what has been said, I think it will be agreed, that a company is under a moral obligation to allow a surrender-value, and that as the reserve may be looked upon as the amount held for the benefit of the policyholders, it should form the basis of the surrender-value, subject to the necessary adjustments to allow for—

(1) Expenses.

(2) Adverse selection.

In the case of a proprietary office there is the further consideration referred to above, namely, the loss of future profit to a part of which the shareholders are generally entitled. In a mutual office, where the profits all belong to the members, this loss of future profit should make no difference to the surrender-value. Probably as a matter of competition proprietary offices would be prepared to forego any compensation on this account, and not, as a matter of course, offer less surrender-values than mutual offices. I propose, therefore, only to consider the case of a mutual office, and not to go into the question of future profits.

But in both cases, whether proprietary or mutual, the fact that the office is liable to pay surrender-values practically on demand necessitates a portion of the funds being kept in readily-convertible securities, with the consequent loss of interest-profit to the general body of policyholders. Further, there is the right to demand some compensation, that one party to a contract has, when the other asks to have the contract cancelled and to be relieved of his undertaking. It cannot be too often pointed out to persons not conversant with the principles of life assurance, that the policyholder is the only party to the contract who has the power to avoid his bargain. The office is in all cases compelled to stand by its obligation, however desirable it might be from a financial point of view to avoid it, in the event of the transaction turning out a bad one, whereas it is open to the policyholder to discontinue the payment of the premium at any time.

#### EXPENSES.

We may now proceed to consider what deductions should be made under this heading. It will, I think, be admitted as a general principle that each policyholder should contribute his

fair share towards the expenses. These expenses may be divided into three classes—

- (a) Initial Expenditure.
- (b) General Expenditure.
- (c) Renewal Expenditure.

With regard to (a). This includes the new business commission or procuration fee, the medical fee, policy stamp, cost of advertising, &c. It represents money already expended and must therefore be repaid to the office in full before any surrender-value can be allowed.

Under the heading of General Expenditure (b) may be classed the cost of maintaining the institution; this will include, among other items, head-office expenses and salaries. These charges have been incurred on behalf of the policyholders as a body, and if any one of them makes default, there is, in consequence, a heavier burden thrown on the remainder. To allow this would not be just to the remaining policyholders; for, if there is any additional burden to be borne as a result of the breaking of the contract, its cost should fall on the party making default. The policyholder has implicitly contracted to contribute towards maintaining the institution during the term for which the policy is written. He should therefore indemnify the company against any loss which may be incurred by his withdrawal.

The Renewal Expenditure (c) relates to the policies individually and will include the costs of collecting the premiums, &c. It will cease with the lapse of the policy, no further liability being incurred by the company in respect thereof, and therefore no deduction will be necessary on this account.

Let  $P'$  = Office Premium.

$r$  = Loading for Initial Expenditure.

$s$  = „ „ General „

$t$  = Balance of Office Premium.

So that

$$P' = r + s + t$$

Now out of each premium that the office receives  $r$  is paid on account of the initial expenditure. Hence the deduction to be made in respect of this portion of the expenses will be an annuity of  $r$  for the remainder of the term for which the premiums are payable. Similarly  $s$  is received each year and expended in paying the general expenses, and as these expenses will continue and will not be reduced to any material extent by the lapsing of the

policy, the deduction in this case may be taken as an annuity of  $s$  for the same term. The balance of office premium  $t$  includes the net premium and the loading for profits and renewals. The net premium is absorbed in payment of the current claims and in providing the reserve; and the loading for profits and renewals is requisitioned for the purposes of bonus and renewal expenses. No deduction will be necessary on account of  $t$ , as the office will suffer no loss by the lapsing of the policy, in respect of this portion of the premium.

The total deduction from the reserve to allow for expenses will thus be :

$$(1 + a)(r + s),$$

where the annuity must be given its proper value according to the class and duration of assurance.

#### ADVERSE SELECTION.

The question as to whether the selection exercised by the assured on withdrawal does adversely affect the future rate of mortality among the continuing members is one that has been much debated, and references to it in the pages of our *Journal* are numerous. The general opinion among actuaries appears to be that there is an adverse selection.

Mr. Chatham, in his monumental essay, "On the Rate of Mortality and Discontinuance among recently selected Lives" (*J.I.A.*, vol. xxix, page 81), appeared to prove, that discontinuances had rather a favourable influence on the future rate of mortality of a company. He admitted, however, that his investigations were not conclusive, owing to the observations upon which they were based being out of date, and Mr. G. King in the discussion pointed out that the conclusions were somewhat vitiated by the inclusion of term policies in the Twenty Offices' Experience.

The subject has been so frequently discussed that scarcely anything fresh remains to be said upon it. For the sake of clearness, however, it may be as well to briefly re-state some of the arguments that have been put forward to prove the existence of a selection against the office on withdrawal, and to consider the bearing of such selection on surrender-values.

General considerations seem to point to the conclusion that the withdrawing members are a class of lives subject to a lighter rate of mortality than that experienced by the continuing members. For if a member is in a bad state of health it is not



likely that the policy will be allowed to lapse, whilst it is fairly certain that when he is in a very advanced stage of disease, no stone will be left unturned in the efforts to maintain an assurance which is so near maturity.

Pecuniary difficulties are frequently the cause of withdrawal. The policyholder is unable to raise the money with which to pay the premium. Unless he can obtain a loan or find a purchaser, the policy of necessity has to lapse. If he is in bad health, as under such circumstances he is quite likely to be, no effort will be spared to induce some of his friends or relatives to assist him to keep the policy in force, so that the benefit of the assurance shall not be lost just at the time for which it was provided. Failing such assistance, he will naturally look round for someone who, knowing his circumstances, will give him more for the policy than the surrender-value. Still, I am aware that sometimes policies are surrendered owing to the life assured having fallen into bad health and having been thereby reduced to poverty. I have even known the surrender-value to be applied for, for the express purpose of paying the doctor. But these are only isolated cases, and the fact remains that when the assured is in an advanced stage of ill-health, generally speaking, the assurance will not be allowed to lapse.

From general considerations, then, it would appear that withdrawals will have the effect of leaving a larger proportion of bad lives on the books, than would be the case if there were no withdrawals. This is only another way of stating that the future rate of mortality experienced by the company will be increased.

Under the conditions of practice, the lives at the time of assuring are all select, but within a short period they become mixed as regards their health. Some will still remain select, and may even be in better health than they were at the time of assuring; others will have become deteriorated and will be in various stages of illness, some actually on their death-beds.

Now leaving out of account the question of expenses; if a number of policyholders withdraw, and are at the time of withdrawal a similar class of lives to the whole body, they may be allowed as surrender-value the full reserve against their policies, without prejudice to those who remain. If, however, they are a better class of lives, the future rate of mortality experienced by the company will be increased by their withdrawal, in which case they cannot be allowed the full reserve, as calculated by the general table of mortality used in the valuation. If we knew the rate of

mortality that would prevail amongst the withdrawing members, we could determine the proper reserve against their policies, which might be granted in full on surrender, without loss to the remainder. We are, however, unable to do this, as when the lives withdraw they are lost to observation and there are no means of tracing them.

Many persons are induced to take out policies almost against their will, and, after paying a few premiums, they allow them to lapse, out of pure indifference. But among these over-persuaded individuals there will almost certainly be some who within a short time will become bad lives. Under such circumstances, these deteriorated lives will in all probability recognize the benefits of life assurance and maintain their policies, although, had they remained in good health, they might have allowed their policies to lapse.

In an office where the business is very much forced, and large commissions are paid for new business, many of the lapses will probably be the result of over-persuasion. For this reason, I am inclined to believe that if the data for an investigation could be obtained, it would be found that the force of adverse selection would partly depend on the means adopted to obtain new business.

The evil effects of a drain of healthy lives due to withdrawals are of course modified and hidden by the introduction of freshly-selected lives, but these new lives, as soon as obtained, are themselves subject to the same drain, with the result that the ultimate body of lives will be subject to a higher rate of mortality.

We constantly hear that the profits from mortality are not what they used to be. In fact they are sometimes of a negative character. The reduction in the mortality profit may be partly accounted for by the large increase in endowment assurances, but there are two other causes which may possibly have been at work. The great competition for new business may have caused companies to relax somewhat the stringency of their selection. In the second place, the decline may be due to the withdrawal of healthy lives. It is, of course, impossible to say which of these two causes has had the greater influence. I believe that companies are just as particular in their selection of lives as ever they were. In fact, owing to the cordial manner in which the companies work together at the present time, they are in a better position to detect attempts to deceive them by intending policyholders. The true cause for the decline in

mortality-profit is, I feel convinced, in many cases due largely to the withdrawals.

In view of the above reasoning, and the absence of any proof to the contrary, I think we may conclude that an adverse selection does exist. If this be granted, it follows that the office or valuation reserve cannot under any circumstances be allowed in full as surrender-value. As an office is unable to go into the question of the health of the assured at the time of withdrawal, it seems reasonable to assume that the withdrawals are Select lives. Making this assumption, we are able, by the use of Dr. Sprague's Select Life Tables, to calculate the values of policies on the lives of those who withdraw, which may be allowed on surrender subject to the adjustment for expenses.

When a policy lapses, the difference between the office reserve and the surrender-value is apparently clear profit, but on theoretical considerations it might be argued that a part should be set aside to provide for the increased mortality of the future. This, however, seems an unnecessary refinement, and I am not aware that it has ever been attempted in practice.

Mr. Crisford allowed for the effect of withdrawals, in calculating surrender-values, by deducting five per-cent from the reserve, and noted that the deductions formed "a series constantly increasing with the duration of the policy." Commenting upon this, he said, "This would appear to be right, because the effect of withdrawal on mortality is greater after a long continuance of the policy than it is soon after selection." I must confess I am unable to agree with him in this statement. It is true that the effect on *mortality* of the withdrawal of a healthy life is greater the longer the duration of the policy, owing to the decreasing proportion of healthy lives. But the reserve is increasing, and the amount at risk, therefore, growing less, until the limiting age of the table is reached, when the reserve will be the full sum assured discounted for interest only, mortality not being involved. It would thus seem that the correct deductions from the office reserve, to allow for adverse selection, would form a series increasing to a maximum and then decreasing to 0.

Table B gives the percentages of Select Life Policy Values found by Dr. Spragues' Select Life Tables to H<sup>M</sup> Policy Values at three per-cent and four per-cent interest.

TABLE B.—*Showing Percentage of Select Life to H<sup>M</sup> Policy-Values.*

Interest 3 per-cent								
Duration	AGE AT ENTRY							
	25	30	35	40	45	50	55	60
3	82·96	93·52	95·43	97·16	94·52	95·91	96·66	95·24
5	86·56	93·04	96·81	95·98	94·66	96·34	96·12	95·96
10	90·30	95·24	96·49	95·77	96·39	96·47	96·34	95·67
15	93·20	95·76	96·25	96·29	96·43	96·67	96·22	93·89
20	94·35	95·90	96·59	96·62	96·73	96·62	94·92	...
25	94·98	96·37	96·85	96·89	96·78	95·59	...	...
30	95·72	96·72	97·08	96·97	95·97	...	...	...
35	96·27	97·03	97·16	96·29	...	...	...	...
40	96·72	97·18	96·56	...	...	...	...	...
45	96·97	96·66	...	...	...	...	...	...
50	96·59	...	...	...	...	...	...	...
Interest 4 per-cent								
3	80·10	92·40	94·91	96·97	94·05	95·62	96·45	94·96
5	84·35	92·12	96·50	95·63	94·82	96·07	95·86	95·71
10	88·81	94·67	96·15	95·39	95·74	96·20	96·09	95·40
15	92·12	95·28	95·86	95·95	96·13	96·40	95·95	93·51
20	93·59	95·43	96·24	96·29	96·43	96·34	94·55	...
25	94·32	95·95	96·51	96·59	96·48	95·22	...	...
30	95·17	96·34	96·77	96·66	95·58	...	...	...
35	95·79	96·68	96·84	95·89	...	...	...	...
40	96·30	96·82	96·15	...	...	...	...	...
45	96·56	96·22	...	...	...	...	...	...
50	96·12	...	...	...	...	...	...	...

The percentages exhibited by this table for the same duration present some irregularities which are possibly due mainly to graduation. At age 25 at entry the percentages commence relatively very low. This may probably be accounted for by the fact that the H<sup>M</sup> premiums at the younger ages at entry are less than the Select premiums. But at all ages at entry, except 55 and 60, the percentages have a decided tendency to increase with the duration of assurance. The Select Life Tables do not go beyond age 75 at entry, so that the table cannot be carried beyond that age, but for the reasons already given one would expect the percentages to increase with the duration of assurance, up to 100 per-cent at the limiting age of the table.

It may, however, be noted that Mr. Crisford's assumption is very near that shown to be required by the above table throughout the greater portion of life.

With regard to the allowance to be made in the surrender-value for the further points already referred to, namely, the loss of interest profit, due to the office having to pay surrender-values on demand and for the fact that the assured desires to withdraw from his bond, it may be considered that these will be sufficiently met by valuing the policy at a higher rate of interest than that used in estimating the liabilities of the office.

We are now in a position to write down the formula for the surrender-value of a policy on the foregoing basis.

Let  $(SV)$  = surrender-value.

$(hV)$  = value of policy assuming the life to be select.

The deduction to be made on account of expenses as already shown is

$$(1 + a)(r + s)$$

Therefore  $(SV) = (hV) - (1 + a)(r + s)$

To the above must be added the cash-value of any bonus additions standing to the credit of the policy, from which no deduction should be made, but adverse selection must be allowed for, by assuming the life to be still select. The rate of interest would be the same as that used in the calculation of the surrender-value.

Before we can actually calculate surrender-values on this basis, it is necessary to assign definite values to the loading for initial expenditure  $r$ , and to that for general expenditure  $s$ .

The initial cost varies considerably between different offices. Very few published accounts give sufficient details of expenditure and business obtained to enable any close estimate to be made of what that cost is. It should, however, be a simple matter for an office to determine from its books, approximately, the average cost of obtaining new business, as a percentage either of the new premiums or of the new sum assured.

I believe it is a common practice to pay commission for new business by a percentage on the sum assured, and that portion of the initial cost which includes the medical fee and policy stamp also partly depends on the amount of the assurance. It would therefore seem that the expenses attending the acquisition of new business may be properly represented by a percentage of the sum assured.

Dr. Sprague has stated (*J.I.A.*, xix, page 450), that he considered a company economically managed, whose expenditure did not exceed 50 per-cent of the new premiums and 7 per-cent of the



renewals. Since that opinion was expressed, the expenses of life offices have increased as already shown in Table A.

This increase is most likely due, largely, to the great competition for new business and partly to the increased general prosperity of the country. And it is a matter for the very serious consideration of managers at the present time, not only how these expenses are to be kept down in the future, but how they are to be reduced. This question of expenses becomes the more urgent in view of the continued fall in the interest-earning power of money.

An examination of the reports of several companies shows that, generally speaking, 2·1 per-cent of the sum assured represents from about 50 per-cent to 60 per-cent of the new premiums. I have therefore assumed that the initial expenditure will be represented by 2·1 per-cent of the sum assured. This will probably be considered as rather a low estimate, but the actual rate of expenditure assumed will not affect the principles of the method.

The general expenditure may perhaps be best represented by a percentage of the premium income. Mr. Crisford assumed that 2½ per-cent of the office premiums belonged to current general expenses, and I have followed him in this respect.

#### WHOLE LIFE.

The formula for the surrender-value of a Whole-Life policy for £100, taken out at age  $x$ , and  $n$  years in force, will thus be

$$100 {}_n(\text{SV})_x = 100 {}_n(hV)_x - (1 + a_{[x+n]})(r_{[x]} + s_x)$$

where  $r_{[x]} = \frac{2\cdot1}{1 + a_{[x]}}$  and  $s_x = 2\cdot5 P'_x$ ,  $P'_x$  being the office premium.

In order to calculate specimen surrender-values by this formula, it was necessary to fix on a table of premiums. As I desired to compare my values with those of Mr. Crisford, I decided to adopt his premiums.

The following is an example of a preparatory table for calculating surrender-values on Whole-Life policies according to above formula.

TABLE C.

Age	100P <sub>x</sub>	s <sub>x</sub>	i <sub>x</sub>	
			3 %	4 %
25	2.167	.054	.097	.112
30	2.507	.063	.102	.117
35	2.924	.073	.108	.123
40	3.365	.084	.116	.130
45	3.893	.097	.126	.141
50	4.656	.116	.140	.154
55	5.670	.142	.158	.172
60	7.184	.179	.184	.197

Table D (pp. 215, 216) gives specimen surrender-values of Whole-Life policies for £100 on the foregoing basis for ages at entry 25, 30, 35, . . . . 60, and durations of 3, 5, 10, 15, &c., years at 3 per-cent and 4 per-cent interest. These surrender-values are compared with

- (1) The amount of premiums paid.
- (2) The select life policy-values found by Dr. Sprague's formula  $n(hV)_x = 1 - \frac{a_{[x+n]}}{a_{[x]}}$ .
- (3) The values by the formula  $_{n-1}(hV)_{x+1} = 1 - \frac{a_{[x+n]}}{a_{[x+1]}}$ .
- (4) The values by the method suggested by Mr. Crisford.
- (5) Average office-values, which were obtained by extracting from the Board of Trade Returns for five years the specimen surrender-values there given (excluding bonus) and taking the arithmetical mean.

With regard to (3) this formula has been suggested for the calculation of surrender-values. Its rationale is that the whole of the first year's premium is absorbed in payment of the initial expenses and current claims. Consequently, the policy has no reserve for the first year and is assumed to have been taken out one year later. Due allowance is made for adverse selection by the use of Select Mortality Tables.

It will be noticed that these values correspond to a remarkable degree, throughout the table, with those of Mr. Crisford and are

TABLE D.

Age at Entry 25.—100  $P_{25}=2.167$ 

Age at Entry 25.—100 $P_{25}=2.167$										
Duration	Total Amount of Premiums paid	SELECT-LIFE POLICY VALUES				SURRENDER-VALUES				
		$100_n(hV)_x$		$100_{n-1}(hV)_{x+1}$		Proposed		Mr. Crisford's		Average Office
		3%	4%	3%	4%	3%	4%	3%	4%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
3	6.450	2.600	2.057	1.813	1.443	-.587	-.979	1.824	1.439	...
5	10.835	4.597	3.691	3.825	3.088	1.476	.706	3.894	3.175	3.367
10	21.670	10.043	8.262	9.315	7.688	7.100	5.418	9.504	7.905	7.229
15	32.505	16.315	13.730	15.638	13.189	13.577	11.056	15.662	13.286	11.429
20	43.340	23.309	20.041	22.689	19.540	20.800	17.563	22.571	19.536	16.626
25	54.175	30.778	26.984	30.218	26.526	28.513	24.721	29.979	26.446	21.454
30	65.010	38.847	34.723	38.352	34.314	36.847	32.700	37.846	34.010	29.150
35	75.845	47.186	42.952	46.760	42.594	45.458	41.184	46.956	42.030	...
40	86.680	55.387	51.246	55.026	50.941	53.927	49.734	53.892	50.075	...
45	97.515	63.281	59.426	62.985	59.172	62.079	58.168	61.580	58.073	...
50	108.350	70.023	66.550	69.782	66.340	69.042	65.513	68.543	65.460	...

Age at Entry 30.—100  $P_{30}=2.507$ 

3	7.521	3.354	2.771	2.261	1.867	.058	-.376	2.150	1.747	...
5	12.535	5.708	4.746	4.642	3.861	2.492	1.663	4.603	3.882	3.783
10	25.070	12.283	10.423	11.291	9.590	9.292	7.523	11.116	9.452	8.292
15	37.605	19.613	16.976	18.705	16.204	16.871	14.288	18.420	15.994	13.504
20	50.040	27.442	24.185	26.622	23.480	24.967	21.731	26.251	23.229	19.217
25	62.675	35.900	32.221	35.176	31.591	33.714	30.027	34.570	31.148	25.542
30	75.210	44.642	40.765	44.017	40.215	42.754	38.848	43.146	39.544	32.800
35	87.745	53.237	49.378	52.709	48.907	51.643	47.739	51.536	47.968	...
40	100.280	61.513	57.871	61.078	57.479	60.201	56.508	59.666	56.331	...
45	112.815	68.580	65.268	68.224	64.945	67.509	64.143	66.026	64.074	...

Age at Entry 35.—100  $P_{35}=2.924$ 

3	8.772	4.051	3.434	2.780	2.361	.666	.191	2.664	2.225	...
5	14.620	6.973	5.960	5.740	4.915	3.691	2.803	5.514	4.687	4.650
10	29.240	14.748	12.839	13.618	11.870	11.740	9.912	13.307	11.595	10.225
15	43.860	23.050	20.407	22.031	19.523	20.335	17.735	21.662	19.235	16.363
20	58.480	32.020	28.844	31.119	28.053	29.622	26.455	30.536	27.593	23.175
25	73.100	41.291	37.814	40.513	37.123	39.220	35.726	39.683	36.458	29.050
30	87.720	50.407	46.855	49.750	46.264	48.657	45.070	48.634	45.350	38.442
35	102.340	59.183	55.772	58.642	55.280	57.743	54.287	57.304	54.178	...
40	116.960	66.677	63.537	66.236	63.132	65.502	62.323	66.158	62.353	...

TABLE D—continued.

Age at Entry 40.—100 $P_{40}=3.365$										
Duration	Total Amount of Premiums paid	SELECT-LIFE POLICY VALUES				SURRENDER-VALUES				
		$100_n(hV)_x$		$100_{n-1}(hV)_{x+1}$		Proposed		Mr. Crisford's		Average Office
		3%	4%	3%	4%	3%	4%	3%	4%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
3	10.095	4.960	4.316	3.391	2.953	1.513	1.017	3.401	2.931	...
5	16.825	8.358	7.315	6.845	5.995	5.035	4.120	6.877	6.014	5.417
10	33.650	17.282	15.363	15.917	14.158	14.282	12.446	15.890	14.161	11.950
15	50.475	26.925	24.334	25.718	23.257	24.275	21.725	25.062	23.081	19.408
20	67.300	36.891	33.873	35.849	32.931	34.603	31.593	35.329	32.538	27.175
25	84.125	46.689	43.487	45.809	42.682	44.756	41.538	44.985	42.026	34.450
30	100.950	56.124	52.969	55.399	52.299	54.533	51.348	54.338	51.446	43.604
35	117.775	64.180	61.226	63.588	60.674	62.881	59.889	62.809	60.167	...
Age at Entry 45.—100 $P_{45}=3.893$										
3	11.689	5.746	5.091	3.936	3.491	2.253	1.718	4.263	3.770	...
5	19.465	9.739	8.683	8.006	7.144	6.394	5.438	8.267	7.382	6.779
10	38.930	20.260	18.362	18.729	16.986	17.306	15.461	18.762	17.050	14.483
15	58.395	31.135	28.654	29.813	27.451	28.583	26.119	29.580	27.300	22.438
20	77.860	41.828	39.027	40.711	37.999	39.672	36.860	40.165	37.583	31.138
25	97.325	52.122	49.257	51.203	48.401	50.348	47.454	50.420	47.792	38.900
30	116.790	60.913	58.166	60.163	57.460	59.465	56.679	59.707	57.245	48.746
Age at Entry 50.—100 $P_{50}=4.656$										
3	13.968	6.888	6.224	4.729	4.275	3.313	2.772	5.219	4.711	...
5	23.280	11.657	10.599	9.608	8.742	8.265	7.308	9.970	9.079	7.842
10	46.560	23.705	21.869	21.936	20.246	20.776	18.992	22.051	20.377	17.054
15	69.840	35.551	33.229	34.057	31.841	33.077	30.771	33.842	31.715	26.246
20	93.120	46.957	44.432	45.727	43.277	44.920	42.386	45.280	42.966	35.617
25	116.400	56.696	54.188	55.692	53.236	55.034	52.501	55.638	53.385	43.800
Age at Entry 55.—100 $P_{55}=5.670$										
3	17.010	8.212	7.553	5.636	5.185	4.563	4.015	6.370	5.866	...
5	28.350	13.638	12.606	11.214	10.368	10.205	9.261	11.885	11.008	9.717
10	56.700	27.047	25.312	25.000	23.399	24.147	22.453	25.334	23.766	20.254
15	85.050	39.958	37.843	38.273	36.251	37.571	35.464	38.363	36.433	30.196
20	113.400	50.982	48.756	49.607	47.444	49.034	46.805	50.159	48.161	42.013
Age at Entry 60.—100 $P_{60}=7.184$										
3	21.552	9.343	8.706	6.449	6.011	5.588	5.049	7.495	7.004	...
5	35.920	15.527	14.539	12.831	12.017	12.028	11.116	13.679	12.838	11.008
10	71.840	30.476	28.878	28.258	26.779	27.596	26.029	28.889	27.447	24.362
15	107.760	43.241	41.365	41.432	39.634	40.889	39.016	42.660	40.974	36.046

throughout greater than those now proposed, the greater difference being in the earlier years of assurance. Dr. Sprague, referring to this formula in the introduction to his Select Life Tables, remarks: "This formula will, I believe, be found very useful in any investigation that may be hereafter made as to the proper surrender-value to be allowed by an insurance company for its policies. It must be assumed unless the contrary is proved, that when it is proposed to surrender a policy, the life is in good health, and, having regard to this consideration, and to the heavy expenditure at which new life business is now obtained, which is often more than is allowed for in the formula, it becomes evident that in general, the surrender-value of a policy should be less than the value got from the formula."

The surrender-values brought out by the proposed method, at four per-cent interest, are negative for ages at entry 25 and 30, duration three years, but it should be borne in mind that the value of any bonus added to the policy has to be included, which would probably allow of a small surrender-value being granted even when only three years' premiums have been paid.

The proposed values (see column 7) are less than the average office values (see column 10) for some years after entry, but at the longer durations they are much greater. Referring to age at entry 25 column (7) is less than column (10) for the first 15 years' duration, after which the former is the greater, the difference increasing with the duration. At ages 30 and 35 at entry, the values in the two columns cross between durations of 10 and 15 years, and thereafter up to age 55 at entry they cross between durations of 5 and 10 years, while at age 60 at entry they are about equal after 5 years' duration.

The small surrender-values given by offices at the long durations, are, I think, probably due partly to the calculations being made by some of those arbitrary methods which do not take into account the circumstances of the case, and partly to the use of those inequitable formulas, which include a fixed percentage deduction of the reserve, whereby the longer a policyholder maintains his policy and contributes to the maintenance of the institution, the greater is the surrender-charge.

Mr. Crisford's values are greater than those by the proposed method for a considerable number of years after the issue of the policy. The greater difference is at the younger ages at entry, the reason for this being that he did not take account in his formula of the initial expenditure. His values will be less at the extreme



durations on account of the 5 per-cent deduction throughout, which he has made to allow for withdrawals and which has been shown to be too great at these periods.

On reviewing the suggested method of calculating surrender-values, it will be seen to be based on the following principles :

- (1) The reserve forms the basis of the surrender-value, such reserve being calculated upon the assumption that the assured is a select life. The ordinary valuation reserve is only an average and cannot be considered to have any relation to the reserve or policy-value of an individual policy.
- (2) The policyholder must repay to the office the initial expenditure or cost of obtaining him as a member.
- (3) He must contribute his proper and due share towards
  - the expenses and profits of the office during his membership.
- (4) He must compensate the office for the loss of his future contributions to the general expenses.

It has been suggested that a policyholder should be looked upon as a shareholder and not be held responsible for any expenses after he has severed his connection with the company. If he has contributed his fair share towards the current expenses and profits during his membership, and has reimbursed the company for the money spent in securing him as a member, this certainly does appear to be a reasonable view. For it may be contended that the company suffers no loss, as the withdrawing member has furnished it with the means to obtain a new member to take his place, who will be equally profitable.

Table E gives the deductions made to allow for expenses, Column (2) of which shows what difference the above suggestion, if adopted, would make in the surrender-values given.

TABLE E.—*Whole Life.—Deductions made on account of Expenses in estimating Surrender-Values.—Interest 3 per-cent.*

Duration	AGE AT ENTRY								
	25			30			35		
	Initial Ex-penses	General Ex-penses	Total	Initial Ex-penses	General Ex-penses	Total	Initial Ex-penses	General Ex-penses	Total
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
3	2·047	1·140	3·187	2·038	1·258	3·296	2·020	1·365	3·385
5	2·005	1·116	3·121	1·988	1·228	3·216	1·958	1·324	3·282
10	1·891	1·052	2·943	1·849	1·142	2·991	1·795	1·213	3·008
15	1·759	·979	2·738	1·695	1·047	2·742	1·620	1·095	2·715
20	1·612	·897	2·509	1·530	·945	2·475	1·431	·967	2·398
25	1·455	·810	2·265	1·351	·835	2·186	1·236	·835	2·071
30	1·285	·715	2·000	1·167	·721	1·888	1·044	·706	1·750
35	1·110	·618	1·728	·985	·609	1·594	·859	·581	1·440
40	·938	·522	1·460	·811	·501	1·312	·701	·474	1·175
45	·772	·430	1·202	·662	·409	1·071	...	...	...
50	·630	·351	·981	...	...	...	...	...	...
	40			45			50		
3	1·999	1·448	3·447	1·973	1·519	3·493	1·955	1·620	3·575
5	1·927	1·396	3·323	1·890	1·455	3·345	1·855	1·537	3·392
10	1·740	1·260	3·000	1·669	1·285	2·954	1·602	1·327	2·929
15	1·537	1·113	2·650	1·442	1·110	2·552	1·353	1·121	2·474
20	1·327	·961	2·288	1·218	·938	2·156	1·114	·923	2·037
25	1·121	·812	1·933	1·002	·772	1·774	·909	·753	1·662
30	·923	·668	1·591	·818	·630	1·448	...	...	...
35	·753	·546	1·299	..	...	...	...	...	...
	55			60					
3	1·922	1·727	3·649	1·898	1·857	3·755	...	...	...
5	1·808	1·625	3·433	1·769	1·730	3·499	...	...	...
10	1·527	1·373	2·900	1·456	1·424	2·880	...	...	...
15	1·257	1·130	2·387	1·189	1·163	2·352	...	...	...
20	1·026	·922	1·948	...	...	...	...	...	...

TABLE E.—*Whole Life.—Deductions made on account of Expenses in estimating Surrender-Values.—Interest 4 per-cent.*

Duration	AGE AT ENTRY								
	25			30			35		
	Initial Ex-penses	General Ex-penses	Total	Initial Ex-penses	General Ex-penses	Total	Initial Ex-penses	General Ex-penses	Total
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
3	2·048	·988	3·036	2·046	1·101	3·147	2·035	1·208	3·243
5	2·014	·971	2·985	2·004	1·079	3·083	1·981	1·176	3·157
10	1·919	·925	2·844	1·885	1·015	2·900	1·837	1·090	2·927
15	1·804	·870	2·674	1·747	·941	2·688	1·677	·995	2·672
20	1·672	·806	2·478	1·595	·859	2·454	1·499	·890	2·389
25	1·527	·736	2·263	1·426	·768	2·194	1·310	·778	2·088
30	1·365	·658	2·023	1·246	·671	1·917	1·120	·665	1·785
35	1·193	·575	1·768	1·065	·574	1·639	·932	·553	1·485
40	1·020	·492	1·512	·886	·477	1·363	·758	·456	1·214
45	·849	·409	1·258	·731	·394	1·125	...	...	...
50	·700	·337	1·037	...	...	..	..	...	...
	40			45			50		
3	2·004	1·295	3·299	1·998	1·375	3·373	1·969	1·483	3·452
5	1·941	1·254	3·195	1·922	1·323	3·245	1·877	1·414	3·291
10	1·772	1·145	2·917	1·719	1·182	2·901	1·641	1·236	2·877
15	1·585	1·024	2·609	1·502	1·033	2·535	1·402	1·056	2·458
20	1·385	·895	2·280	1·284	·883	2·167	1·167	·879	2·046
25	1·184	·765	1·949	1·068	·735	1·803	·962	·725	1·687
30	·985	·636	1·621	·881	·606	1·487	.	...	...
35	·812	·525	1·337	...	...	...	...	...	...
	55			60					
3	1·938	1·600	3·538	1·916	1·741	3·657	..	...	...
5	1·832	1·513	3·345	1·793	1·636	3·423	...	...	...
10	1·566	1·293	2·859	1·493	1·356	2·849	...	...	...
15	1·303	1·076	2·379	1·231	1·118	2·349	...	...	...
20	1·074	·887	1·951	...	...	...	...	...	...

It will be noticed that if no deductions be made on account of future general expenditure, the surrender-values by the present method will still be less than Mr. Crisford's values, for about the first 15 years of assurance. After that period they will be about equal, the difference being most marked at the younger ages at entry.

The total deductions made for expenses represents what may be termed the surrender-charge, and, as would appear perfectly right and natural, this charge constantly decreases with the duration of the policy.

## ENDOWMENT ASSURANCES.

The formula for the surrender-value of an endowment assurance for £100 taken out at age  $x$  for  $t$  years, duration  $n$  years, in accordance with the foregoing theory will be :

$$100_n(\text{SV})_{x\bar{t}} = 100_n(hV)_{x\bar{t}} - (r_{[x]\bar{t}} + s_{x\bar{t}})a_{[x+n]\bar{t-n}}$$

where  $r_{[x]\bar{t}} = \frac{2.1}{a_{[x]\bar{t}}}$  and  $s_{x\bar{t}} = 2.5 P'_{x\bar{t}}$ ,  $P'_{x\bar{t}}$  being the office premium.

For the purpose of calculating a table of specimen surrender-values it is desirable to use such office premiums as may be considered to fairly represent the average rates charged in practice.

As the rates charged by different offices for this class of benefit vary considerably, I have thought it desirable to calculate a set of premiums, which may fairly be taken to meet the conditions generally prevailing.

The basis upon which these premiums have been worked out is as follows :—

The  $H^M$  Table of Mortality with  $3\frac{1}{2}$  per-cent interest, and loaded for

Initial Expenditure 2.1 per-cent of Sum Assured.

General „ 2½ per-cent of  $P'$ .

Renewal „ 5 per-cent of  $P'$ .

Profits—Uniform Reversionary Bonus of 1 per-cent per annum.

The following is the table giving the premiums at quinquennial ages. I venture to express a hope that apart from the purpose for which they were calculated, they may prove of some interest as a rough standard of comparison with other tables of office premiums.

*Endowment Assurance Office Premiums.*

Term	25	30	35	40	45	50
15	6.836	6.912	6.998	7.122	7.332	7.654
20	5.077	5.163	5.275	5.436	5.705	...
25	4.045	4.147	4.287	4.495	...	...
30	3.382	3.506	3.672	...	...	...
35	2.939	3.092	...	...	...	...

The following is an example of a preparatory table for calculating surrender-values on endowment assurances.

TABLE F.

Term $t$	$P'_{30 \overline{t}}$	$s_{30 \overline{t}} = 25P'$	${}^2[30] \overline{t}$	
			3 %	4 %
15	6.912	.173	.181	.192
20	5.163	.129	.148	.160
25	4.147	.104	.130	.143
30	3.506	.088	.118	.132
35	3.092	.077	.111	.125

Table G gives specimen surrender-values of endowment assurances for £100, age at entry 30, for endowment terms of 15, 20, 25, 30, and 35 years, and durations of 2, 5, 10, &c., years, at 3 per-cent and 4 per-cent interest. These values are compared with—

(1) Amount of premiums paid.

(2) The Select Life Policy-Values by Dr. Sprague's

$$\text{formula } n(hV)_{x\overline{t}} = 1 - \frac{a_{[x+n] \overline{t-n}}}{a_{[x] \overline{t}}}$$

(3) The values by the formula

$${}_{n-1}(hV)_{x+1:\overline{t-1}} = 1 - \frac{a_{[x+n] \overline{t-n}}}{a_{[x+1] \overline{t-1}}}$$

(4) Average office-values, which were obtained by extracting from the Board of Trade Returns for five years the specimen surrender-values there given (excluding bonus) and taking the arithmetical mean. When age 30 was not given the value for the nearest age was taken. This does not materially affect the figures, as the surrender-values for the same original term and duration vary but slightly for small differences in the age at entry.



TABLE G.—Age at Entry 30.

Term 15 Years.—100 $P_{30:15} = 6.912$								
Duration	Total Amount of Premiums Paid	POLICY-VALUES				SURRENDER-VALUES		
		$t(hV)_{x:n }$		$t-1(hV)_{x+1:n-1 }$		Proposed		Average Office
		3 %	4 %	3 %	4 %	3 %	4 %	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2	13.824	10.256	9.581	5.483	5.127	6.564	5.967	...
5	34.560	27.132	25.701	23.274	22.041	24.135	22.732	20.458
10	69.120	59.972	58.343	57.894	56.291	58.327	56.678	48.608
Term 20 Years.—100 $P_{30:20} = 5.163$								
2	10.326	6.979	6.320	3.658	3.309	3.331	2.773	...
5	25.815	18.387	16.906	15.473	14.235	15.187	13.760	13.167
10	51.630	40.496	38.216	38.371	36.230	38.163	35.877	30.854
15	77.445	67.274	65.280	66.106	64.164	65.991	63.965	54.708
Term 25 Years.—100 $P_{30:25} = 4.147$								
2	8.294	5.089	4.487	2.633	2.318	1.497	1.011	...
5	20.735	13.368	11.946	11.127	9.947	10.090	8.742	9.275
10	41.470	29.341	26.885	27.512	25.226	26.667	24.225	21.404
15	62.205	48.423	45.585	47.088	44.350	46.471	43.601	36.813
20	82.940	71.482	69.266	70.743	68.569	70.403	68.147	59.529
Term 30 Years.—100 $P_{30:30} = 3.506$								
2	7.012	3.930	3.369	2.013	1.723	.420	— .019	...
5	17.530	10.268	8.935	8.477	7.383	6.990	5.742	6.950
10	35.060	22.430	19.996	20.882	18.633	19.596	17.191	15.888
15	52.590	36.758	33.618	35.496	32.487	34.448	31.390	27.588
20	70.120	53.651	50.408	52.726	49.563	51.958	48.669	42.417
25	87.650	74.204	71.816	73.689	71.336	73.261	70.828	62.283
Term 35 Years.—100 $P_{30:35} = 3.092$								
2	6.184	3.180	2.679	1.618	1.358	— .260	— .623	...
5	15.460	8.286	7.056	6.806	5.794	5.027	3.903	5.525
10	30.920	18.026	15.707	16.704	14.562	15.113	12.847	12.213
15	46.380	29.312	26.157	28.172	25.154	26.800	23.652	20.542
20	61.840	42.270	38.654	41.339	37.821	40.219	36.573	31.433
25	77.300	57.571	54.064	56.887	53.440	56.063	52.506	44.671
30	92.760	76.122	73.611	75.737	73.253	75.274	72.716	60.375

It will be noticed that at the shorter durations there is not so marked a discrepancy here between the proposed values and the average office values as in the case of whole-life. Competition does not yet appear to have induced companies generally to grant, upon their endowment assurances at the shorter durations, surrender-values which result in a loss. Although, however, it appears that some companies grant surrender-values for this class of policy after two years' premiums have been paid, which by comparison with the proposed values would be considered generous, yet, generally speaking, the surrender-values given for endowment assurances appear to accord more with the prevailing conditions than do those given for whole-life assurances.

The method of assuming the first year's premium to be used up in payment of new business charges and current risk (see column 5) gives values approximating to the proposed values for original terms 15 and 20 years. But where the term is longer, it does not seem to make sufficient allowance for the expenses of obtaining the business.

Table H gives the deductions made to allow for expenses at 3 per-cent and 4 per-cent interest.

[*Table H, page 225.*]

With regard to the Free Policy to be allowed on surrender, it would seem equitable that it should be based upon the surrender-value, and where this includes a deduction on account of future expenses, the surrender-value should be converted into reversion by the net single premium on the valuation basis, but if no allowance has been made for future expenses then a loaded premium may be used.

It is beyond the scope of this paper to discuss the surrender-values to be allowed on special classes of policies. The principles put forward appear to hold generally, and can be readily applied to any particular class of policy which carries a surrender-value. If these principles are correct and the assumptions upon which the specimen values are based at all accord with the conditions prevailing in practice, then it would appear that the surrender-values allowed by most companies for whole life policies at the shorter durations, where the great majority of surrenders occur, are decidedly liberal.

It is not suggested that the values brought out in this paper are those that should be allowed in all cases. The circumstances

TABLE H.—*Endowment Assurance.—Deductions made on account of Expenses in estimating Surrender-Values.—Age at Entry 30.*

Duration	Original Term. Interest 3 per-cent.								
	15			20			25		
	Initial Ex-penses	General Ex-penses	Total	Initial Ex-penses	General Ex-penses	Total	Initial Ex-penses	General Ex-penses	Total
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
2	1·888	1·804	3·692	1·949	1·699	3·648	1·996	1·596	3·592
5	1·532	1·465	2·997	1·710	1·490	3·200	1·821	1·457	3·278
10	·841	·804	1·645	1·247	1·086	2·333	1·486	1·188	2·674
15	...	...	...	·686	·597	1·283	1·085	·867	1·952
20	...	...	...	...	...	...	·600	·479	1·079
	30			35					
2	2·011	1·499	3·510	2·031	1·409	3·440	...	...	...
5	1·878	1·400	3·278	1·924	1·335	3·259	...	...	...
10	1·623	1·211	2·834	1·720	1·193	2·913	...	...	...
15	1·323	·987	2·310	1·483	1·029	2·512	...	...	...
20	·970	·723	1·693	1·211	·840	2·051	...	...	...
25	·540	·403	·943	·890	·618	1·508	...	...	...
30	...	...	..	·501	·347	·848	...	...	...
Original Term. Interest 4 per-cent.									
	15			20			25		
2	1·901	1·713	3·614	1·964	1·583	3·547	2·012	1·464	3·476
5	1·562	1·407	2·969	1·742	1·404	3·146	1·855	1·349	3·204
10	·876	·789	1·665	1·295	1·044	2·339	1·540	1·120	2·660
15	...	...	...	·728	·587	1·315	1·146	·834	1·980
20	...	...	..	...	...	...	·648	·471	1·119
	30			35					
2	2·033	1·355	3·388	2·043	1·259	3·302	...	...	...
5	1·916	1·277	3·193	1·951	1·202	3·153	...	...	...
10	1·683	1·122	2·805	1·770	1·090	2·860	...	...	...
15	1·397	·931	2·328	1·550	·955	2·505	...	...	...
20	1·043	·696	1·739	1·288	·793	2·081	...	...	...
25	·593	·395	·988	·964	·594	1·558	...	...	...
30	...	...	...	·554	·341	·895	...	...	...

of individual offices vary considerably. Moreover, it would mean a reduction in the minimum surrender-values quoted by many companies. I recognize the difficulty, I might almost say the impossibility, of making a retrograde movement in this matter

(which might do more harm than good, unless made by companies as a body), but it certainly does appear as if, generally speaking, companies have gone quite far enough in their generosity to the fickle or unfortunate policyholder.

It may be considered that sufficient compensation for liberal surrender-values is obtained in the shape of increased popularity. The amount of new business transacted as a result of this liberality cannot, however, be ascertained, and I am inclined to think it must be exceedingly small. However this may be, it is as well that we should bear in mind, that whole-life policies, when surrendered within a few years of their issue, are seldom a source of real profit.

Whether surrenders are a source of profit or not, it is to the best interests of a company to discourage them to the utmost. A certain amount of new business is necessary to make up the inevitable waste by withdrawals and claims. Failing this, symptoms of decay would soon make their appearance. From this, it follows that efforts should be made, not only to obtain new business, but to retain the existing business, more especially that of short duration, which has been so expensive and troublesome to secure, and which may be looked upon as the life-blood of the institution. With regard to the older policyholders, it is generally more to their interest to maintain their policies, even if the company gives surrender-values on the most liberal scale. Moreover, the secession of these members does not inflict so great a loss on the company, and consequently they may be treated with more liberality than generally appears to be the case.

The practice of companies in regard to the allowance of surrender-values, as exemplified by the statements in their prospectuses, is very complicated. Out of 72 companies, it was found that 41 grant surrender-values when three years' premiums have been paid. The minimum amounts then allowed, where stated, are variously described as some percentage, varying from 30 per-cent to 50 per-cent of the premiums paid, or the premiums paid excluding the first. The matter is further complicated by the bonus being allowed in addition in some cases and not in others. Fourteen of the companies allow surrender-values after two years' premiums have been paid, and seven after the payment of one premium, while three do not make any allowance until five years' premiums have been paid. Of the remaining seven companies, two make no reference in their prospectuses to

surrender-values, and the others state that surrender-values are allowed, but do not state when a surrender-value is first acquired. Of the forty-one companies who grant surrender-values after the payment of three years' premiums, seven of them make an exception in the case of endowment assurances and allow surrender-values on these policies when two years' premiums have been paid.

Any attempt to classify the companies with regard to the minimum surrender-values allowed, would be next to useless, on account of the complications referred to above. Moreover, the circumstances of the companies vary so much, that no sound conclusions could be drawn from a comparison of these values. One fact, however, stands out clearly, namely, that the guarantee of surrender-values is very general. It is quite the exception to find a company that has retained its freedom and not tied its hands in this matter. While a company is in a prosperous condition and doing a reasonable amount of new business, the actual surrender-values allowed, whether guaranteed or not, are not of much importance, and even if they involve a small loss they are no danger to the strength of the company. This may be fairly said of British companies as a whole at the present time. Yet even a well managed company may be unfortunate, and incur a serious loss on its investments, through some unexpected financial disaster, whereby it may be reduced to a state of temporary instability, requiring a considerable amount of time and labour to repair.

Under such circumstances the company would be likely to find its surrenders increase to a large extent. It would lose the very best of its business while the worst would undoubtedly remain. If the minimum surrender-values have been guaranteed on a liberal scale, the trouble will be much intensified and the company brought nearer the brink of failure.

Mr. Ryan has uttered a note of warning against guaranteed surrender-values. He says\*—"The guarantee of surrender-values upon the scales at present in vogue must be admitted to involve such reserves as will greatly hasten the period when a weak office is compelled to wind up its affairs, or transfer its business to a more vigorous rival." In the same paper he shows that the price at which a company would be willing to take over the

\* *J.I.A.*, vol. xxxii, page 31.



business of an unfortunate rival, would be considerably influenced by the guarantee of minimum surrender-values.

Surrender-values have no doubt advanced to the present liberal scales as a result of competition. And it would seem to be a point well worthy of consideration, whether in the case of whole life assurances at the short durations, the limit has not been reached. I do not believe that the actual surrender-values allowed, add much to the popularity of an office. When it comes to the surrender of a policy, the policyholder is seldom content, however liberal the surrender-value. Nothing short of the return of the whole of the premiums paid will really satisfy him, even if he does not expect interest in addition, and it seems hopeless to attempt to give satisfaction to the policyholder in this matter. Possibly in some cases, a few pounds more or less, in the prospective surrender-value, may influence an intending assured in the choice of an office, but there are so many other points to be considered, that the surrender-value can only have a partial influence. It is therefore, I think, open to grave doubt whether sufficient compensation is obtained, in the shape of new business, for surrender-values, which do not make due allowance for expenses and adverse selection.

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#### DISCUSSION.

The PRESIDENT (Mr. H. W. Manly) said the Institute had not only to welcome Mr. Fulford as a new contributor to the proceedings, but to congratulate him upon the production of a very interesting and practical paper. It was exactly the kind of paper which it was useful to have; and if he had been, as the author said, instrumental in inspiring him to write the paper, he could only express his pleasure at having done some good to the Institute, and to Mr. Fulford in bringing him out. The paper dealt with a subject which was a matter of daily practice, and the question was one on which no doubt many and varied views were held, so that it ought to lead to a most interesting discussion. There was one point which he thought would bear a good deal of consideration, and that was whether the selection exercised by the policyholder was so great that he should be rated as equivalent to a newly-examined select life at the age attained. He thought that the better measure of the effect upon the mortality caused by withdrawals would be found by comparing the mortality in non-commission paying offices, where lapses were practically unknown, and surrenders were generally caused by necessity, with the mortality in other offices. Two of such companies had published

their experience, one would follow very soon, and he believed it was in contemplation by the actuary of the fourth company to collect that experience when he received the cards back from the Institute. They would then have a basis upon which the effect of the withdrawals might be fairly well estimated. Mr. Fulford, perhaps wisely, had limited his paper to the theoretical part of the subject, but in the discussion of the question the practical side might also be considered. Policies were now freely sold at the Mart, particularly if they were twenty years old or more, and the life was over sixty. The reason for that came out clearly in the table in the paper, where the author showed that the average surrender-values allowed by the offices for policies twenty years old and upwards were much less than the offices could allow for them by any of the methods which he had adopted in his calculations. The practice of taking a percentage off the reserve-value was condemned. As to whether sales of the policies in the open market should be encouraged there was, on the one side, the argument that if a person wishing to withdraw is a select life, it is to the benefit of the office that this policy should remain in force; but, on the other hand, if he is not a select life—and enquires were generally made on the point before the policies were purchased in the open market—it would seem to the advantage of the offices to give at least the full value to redeem its liability. The last question opened up another consideration which might be described as coming within the ethics of life assurance business. What were the principles, and how far could they be justified, which induced one company to go into the market and purchase policies in another company at a higher price than it would give for the purchase of its own policies? If the answer was that it valued the probable bonus additions that would be made to the policy in the other offices, should it not also, in calculating the surrender-values of its own policies, take into consideration the prospective bonuses which might be added to such policies? If the purchasing company said it had made enquiries and found the life was a bad one, should not the company make the same enquiries when it was asked for the surrender-values of its own policies? Then, again, how far was a company justified in going into the market and bidding for the purchase of its own policies at a higher price than it had already offered over the counter? He felt that the open sale of policies and their purchase by other companies must, sooner or later, make a great difference in the treatment of surrender-values. The open market created a double selection, and the offices must take measures accordingly. Theory must be supplemented by practical considerations.

Mr. G. S. CRISFORD said the importance of the subject was illustrated by the fact that since he wrote about it some twenty years ago, double the amount was paid for surrender-values every year. Something like a million a year was paid, and therefore, as a practical result, there was no doubt that the subject deserved careful consideration. He was very pleased that Mr. Fulford had dealt with the matter more particularly from a theoretical point of view, because while it was true that the market value was put forward by some persons as a true indication of the value of a commodity—

namely, that whatever it would fetch in the open market was its value—there was a great deal of danger in being led to conclusions with regard to office practice, by the value that might be set upon a policy in the open market. As the President had pointed out, there were many things which might have influence. A man might be in bad health at the time, and the people who went into the market and purchased the policy might be aware of the fact while the company might not, and therefore the office could not take cognisance of the state of health of its policyholder at the time its surrender-value was demanded. He believed it was a fact that policies had been purchased in the open market at a higher value than that at which a new policy could be purchased in the very office in which the policy was sold. They could see at once the great danger of falling into an error of that kind, and therefore, while it was true that as practical men they had to view the practical side of the subject, yet as conducting the business of insurance companies it was equally important not to lose sight of the theoretical side, and theory should not be lost sight of in practice. The basis of the value, as Mr. Fulford had said, should be first of all the reserve-value, namely, the amount on the books held as against the liability, the amount which in the returns to the Board of Trade had been included in the Valuation Schedule; for while there might be certain cases in which it would be good policy for an office to give more than the reserve-value if thereby it could relieve itself of a greater liability, yet he did not think, in discussing the question as a matter of office practice, that such matters could be taken into consideration. The author had pointed out, very rightly, a difference in the method which was adopted when he (Mr. Crisford) wrote his paper in 1879, and that which the author had now adopted in dealing with the question of expenses. In those days it was very rare, he believed, for a commission to be paid at the rates now paid by most insurance companies. The old rates were usually 10 per-cent of the first year's premium, and 5 per-cent of the renewals, and therefore the loading on the first year's premium was comparatively slight over and above the loading of all the premiums, and no doubt that had an important effect in forming tables of surrender-values. Now it was very different; not only was a higher rate of commission paid upon the first year, but there were greater official expenses to be incurred, and he entirely agreed with the author that in considering any question of surrender-value which should be paid to a policyholder upon his withdrawal, both initial expenditure and the general expenditure of the office should be taken into consideration. He was not quite sure whether the better plan would not be the simpler one, namely, to ignore the first year or two of the premiums paid as covering that special initial expenditure, rather than treating it as a charge upon all the future premiums in the office. Of course, if offices paid a surrender-value after only one premium had been paid, then the provision must be taken as a measure against all the future premiums; but if it was, as he believed it was, the custom of a large number of offices to withhold surrender values for the first two or three, and sometimes for a longer period of years, then, in any calculation of surrender-values, the official expenditure might be best

made by ignoring the first two years' premiums. On the question of the influence of mortality, it was quite true that the difference in reserves brought out by a select table of mortality and the ordinary table showed a decreasing ratio, and when he dealt with the matter some time ago, the allowance he made for effect of withdrawal upon selection was a constant percentage. His reason for doing that—and he still maintained very much the same view—was that while it was true that in the difference between selected lives and the ordinary lives the reserve brought out by such tables was a decreasing one, the effect of withdrawals was just in the opposite ratio upon mortality. When the policy was first taken out, for the first year or two the effect of selection was very slight indeed, and he thought the number of withdrawals did not greatly influence the effect of mortality upon the remaining body; but when surrender-values were asked for at a later date, then the probability was that it would be the good lives mainly who took the surrender-values, and, as pointed out by Mr. Fulford, that bad lives would make every possible struggle to keep up their policies. The effect of the two things, therefore, being in opposite ratio, he was not sure that a general percentage was not sufficient to meet the effect upon mortality. On the question of legal liability to pay surrender-values, it had to be recognised, and still more so now that the endowment assurance policies formed so large a proportion of the business of insurance companies, that the companies acted very much as trustees, for, at any rate, a portion of the contributions which were entrusted to their care in the shape of premiums. Premiums consisted of two parts: that which was paid for the risk, and that which was paid as an accumulation and saving; and he did not think it was possible to ignore the fact that, to the extent of the saving principle which was included in life assurance, even whether it was a whole-life policy or an endowment assurance, there was a legal liability on the part of companies taking that trust into their care by the receipt of premiums. It was recognized, of course, by all the companies, because in their prospectuses they made statements that values were allowed, and in the Board of Trade returns the statement was required to be made as to the basis on which those surrender-values were calculated, or the companies had to give some specimens of the values which were allowed to policyholders on the surrender of their policies. Therefore, while he agreed with the author that it was desirable that offices should discourage as much as possible surrenders, the fact must not be ignored that there really rested upon the companies a legal liability to return a portion of the contribution which a policyholder might make by way of accumulation, apart from the life risk savings. The author had referred to a point which he did not think it was necessary to place so much weight upon as he did, namely, that as a surrender-value was a sum payable on demand, companies had in consequence to keep in their hands certain investments which were easily realisable. He thought that if the payments were looked at which were paid by insurance companies generally, the payment of claims would much more largely represent payments upon demand, and therefore the amount of convertible securities



which would have to be held would not be greatly influenced by merely having to pay surrender-values.

Mr. OWEN KENTISH was very glad to have an opportunity of adding his thanks to those which had already been expressed to the author for so interesting a paper opening a discussion on a most practical subject. The question was one which constantly came before actuaries as officials of life offices, and was one of those comparatively few questions discussed at the monthly meetings that the average outside man knew, or thought he knew, something about. He thought that the discussions of the Institute did interest the average business man more than they had done in the past, and that must be considered an unqualified gain. In the discussion that followed the reading of Mr. Crisford's prize essay, the then President, Mr. Bailey, said that when the Life Assurance Company's Act was before the House of Commons, the question was one in which the hon. members took the keenest interest, and all actuaries could testify that that keen interest still prevailed from the number of times they were called upon to quote to an intending proposer the exact amount he would be allowed for the surrender-value of his policy at the end of a given term. As the author said, he supposed it would be always quite impossible to explain to the ordinary policyholder what a surrender-value was, but he thought the confusion on the point might perhaps be due, to some extent, to the very different values which were quoted by offices whose financial standing and position were alike irreproachable. In two offices, which were in the very front rank of insurance institutions, he had looked into the value of the policies as a matter of interest, and found that the value he should place on a policy in the one office as an investment invariably fell short of the office surrender-value, sometimes by as much as 15 per-cent, whereas in the other case he could always arrive at a value very much in excess of the office value, sometimes as much as 35 or 40 per-cent. When such wide discrepancies existed, without any desire to have a uniform rule which should bind all societies in connection with surrender-values, it did seem desirable that, as officials, they should consider their position in the matter, and, if necessary, rectify any mistakes which they had been making in their practice. He quite agreed with what had been said by Mr. Crisford with regard to the keeping of money in readily convertible securities to pay surrender-values. Most companies found it quite impossible to get an adequate rate of interest on permanent securities, such as mortgages and reversionary investments, and had had to turn to the Stock Exchange, and their investments there were more than enough to supply any demands which surrender-values might make upon them. The author stated that that portion of the initial cost, which included the medical fee and policy stamp, also partly depended on the amount of the insurance. He (Mr. Kentish) thought that in the majority of offices the amount of the proposal had no effect whatever upon the fee offered to the medical examiner. It was quite as necessary to get a careful report when a policy was for £100 as for £500, and it appeared to be false economy to regulate the amount paid for medical examination by the amount of the proposal.



Turning to the table of surrender-values, it seemed a little startling to see negative-values appear in that table, and it appeared to him that this was, to a certain extent, a condemnation of the principles upon which the values were arrived at, especially at the younger ages. He thought there were very few members present who were prepared to admit that a policy taken out for the whole term of life, on which three full annual premiums had been paid, could, upon withdrawal, result in a loss to the office issuing the policy. If the new business were obtained at a reckless expenditure, it might be the case, but that would not apply to any of the offices represented by the Institute. Therefore, he thought the tables should be scrutinized very carefully to see how the negative-values were arrived at. He thought that, to a certain extent, the contributions for future expenses penalized, to an undue extent, a young life that withdrew. Taking the values given, it amounted to practically 50 or 60 per cent of the office premium, which certainly seemed a large contribution to ask a man to make on withdrawing. There was also the point which had already been referred to, that, at those young ages, after a policy had been only a few years in force, the effect of selection was not as much as had been assumed. After looking at a very large number of cases in which policies had been taken out on young lives and surrendered after a few years, he had come to the conclusion that selection against the office in such cases was practically non-existent. In the majority of cases the statement was that the proposer was unable to keep up the policy, and usually it was a perfectly true statement. Companies did not wish to have on their books policies on the lives of people who were not in a sufficiently good financial position to keep up a small policy of life assurance. The deductions on these heads would quite account for the negative-values which appeared at the young ages. After a policy had been a number of years in force, a select-value was a perfectly legitimate reserve on which to base calculations. Turning to the question of the surrender-value of an endowment assurance policy, which the author treated on the same principles as those upon which he based his values for the whole-life policy, it seemed to him that such cases were very largely governed by the conditions as to non-forfeiture of such policies set out in the company's prospectus. In almost all cases now offices allowed that each premium paid, subject in some cases to the deduction of one premium, should secure a benefit which bore the same proportion to the total benefits assured as the number of premiums already paid bore to the total number payable. The surrender-value of an endowment assurance policy should have a direct relation to the surrender-value which an office would be prepared to pay for the paid-up policy for which the insured had the right to call. It was beyond the scope of the paper to discuss whether those paid-up policies were too large or not; he merely referred to the general principle. As to the values to be given for a paid-up policy, perhaps some of the members would be prepared to purchase them at the same price that they would give for an absolute reversion of the same amount in the open market. In any case, it seemed to be an anomaly which was certainly inexplicable to

the ordinary business man, and which he did not think could be defended, that, by the mere act of converting his policy to a paid-up policy, a man could, to a material extent, alter the surrender-value which the office was prepared to pay him. That, of course, applied equally to the general remarks in the paper as to the paid-up policy which should be granted in lieu of surrender. The author stated that "The surrender-value should be converted into reversion by the net single premium on the valuation basis", and in the following paragraph stated that the principles put forward appeared to hold generally—that was to say, that prior to taking a paid-up policy in lieu of a surrender-value, an amount was arrived at which was then converted by a 3 per-cent pure premium. After the policy had been converted, he was sure no member of the Institute would be prepared to give a 3 per-cent pure value for the paid-up policy, but, unless they did so, the result was arrived at that, by the mere act of converting his policy into a paid-up policy, a man reduced by a very considerable amount the sum which the office was prepared to pay him for the surrender-value. A conclusion of that kind was one which it was absolutely impossible to make a man understand who had no knowledge of the subtleties of life assurance.

Mr. A. D. BESANT agreed with the President, that the author had rendered a valuable service to the Institute in putting before it in such a clear way points which had to be taken into consideration in determining a scale of office surrender-values. Perhaps the deductions which the author made were a little heavy, and Mr. Kentish had pointed out one or two of the causes of that. Another cause was that the premium which the author had used included a contribution for profits, and the result was that a non-profit policy would have a different value to a with-profit policy. If the author took a non-profit instead of a with-profit premium, it would give larger values to policies of short duration, and at the same time would put the two classes into harmony. The section in which the author dealt with adverse selection was extremely interesting. There seemed to be a general impression that adverse selection did exist, but its intensity or extent seemed to be quite undetermined. He could not help feeling that there was far less force in the argument than was considered to be the case formerly. For example, Dr. Sprague, in a letter (*J.I.A.*, xxxii, 197), in 1895, discussing the question of the law of maximum mortality percentages, stated that in 1870 he thought that the law might be accounted for as the effect of the withdrawal of healthy lives. Dr. Sprague added: "I believed that its existence proved that the lives which withdrew were on the average better than those which remained. *I now entertain considerable doubt on this subject*"—showing that he had modified the position he set up in 1870. In connection with the same matter, it might be of interest to the Institute if he (Mr. Besant) quoted some statistics as to the cause of surrender in the case of an office paying commission, and doing a steady new business of a permanent character. He found that out of 1,085 cases that were investigated in the last six years, no less than 840, or 77·4 per-cent of the whole, were given up entirely from impecuniosity. Of the balance, 193, or

17·8 per cent. were given up on account of the purpose for which the policy was taken out having been served, and in 52 cases, or 4·8 per-cent, nothing could be ascertained as to why the policy was surrendered. It was interesting to notice that impecuniosity accounted for at least three-quarters of the whole, and he thought that before a man gave up his policy he would make every possible effort to maintain it, and that the difficulties and anxieties through which he would pass before sacrificing his insurance must tend, on the average, to diminish the vitality. So that, so far as that class was concerned, a class numbering 77 per-cent, he thought it might be said they were at least below the average of the general body. On the other hand, those who gave up their policies on account of the purpose having been served, would be above the average, otherwise they would keep the policy up another year or two until their health got re-established. Taking the body as a whole, he thought it was a fair conclusion to come to that their mortality did not differ much from that of the general body of the policyholders, and that if an office made its valuation by the combined  $H^M$  and  $H^{M(5)}$  Tables a shade of difference might be compensated for from a theoretical point of view by the adoption of the ordinary  $H^M$  Table. That, of course, dealt with the author's position entirely from a theoretical standpoint, but in dealing with it from a practical standpoint, objections were much more serious. In the first place, the author's formula was much too complicated. The values brought out for some ages would be such that no office would be able to quote them. The essentials of a good practical working formula would be three—first, simplicity; second, an adequate and not excessive deduction for withdrawal; and third, a value which would be fairly consistent with what the policy would fetch in the open market. With regard to simplicity, he had already considered the  $H^M$  Table from the point of view of mortality, and from a practical point of view its use had the great advantage that so many of the functions were tabulated. In these days, when offices were willing to make calculations without imposing any charge, banks, mortgagees, &c., were always asking, as a matter of course, the surrender-value merely for book entries, and it became a serious strain upon the actuarial staff, so that the adoption of a simple formula became of the utmost importance. It was necessary to minimize labour as much as possible, and get the values calculated and checked in the simplest possible fashion. He thought the best formula from that point of view was the one adopted by Mr. King and other authorities, namely, the  $H^M$  Table, with a high rate of interest—say,  $4\frac{1}{2}$  per-cent, with one year knocked off the duration. That value fitted all the conditions, was quite simple to obtain, and gave a good but not excessive fine, especially when an office had to pay a value after the second payment of the premium. For policies of long duration, it gave a value fairly consistent with the market price. In fact, he thought it would be found that an office valuing on that line would hardly ever find its policies quoted in the open market. The question of endowment assurances was a much more difficult one. It was difficult to combine in any one formula



an expression which was equally suitable for contracts of short and long duration. He had no doubt that was a matter which had attracted the attention of many other members of the Institute, and perhaps they would be able to find some more suitable formula. The best that he could suggest was the  $H^M$  3 or  $3\frac{1}{2}$  per-cent, with a percentage deduction, that percentage deduction being based on the number of outstanding premiums. Thus, if there were ten payments still to make, a 10 per-cent fine would give a fairly good result. He did not say it would apply in extreme cases—there must be a limit—say, 30 per-cent as a maximum, and 5 per-cent as a minimum. Mr. Fulford had quoted both the 3 per-cent and 4 per-cent values in his paper, but he had hardly explained under what circumstances he would consider one set of values more applicable than another. He (Mr. Besant) thought that in the case of an office valuing at  $2\frac{1}{2}$  per-cent, Mr. Fulford probably would give the larger values at 3 per-cent, but he might perhaps explain that. Another difficulty was as to how he obtained his select functions. He thought the author must have taken considerable trouble to calculate them himself, because, as far as he was aware, they were not yet published, except a few select ones in Dr. Sprague's paper.

Mr. JAMES CHATHAM thought the Institute was much indebted to Mr. Fulford for bringing before it so important a question as surrender-values and the principles underlying their calculation. He was glad, however, that the author did not put forward his method as one which should be adopted, but rather as affording a means for the general discussion of the question. The author had referred to an essay of his (Mr. Chatham's) which he wrote some ten years ago, dealing with the effect of withdrawals on the rate of mortality, but he would like to correct a misapprehension on the author's part with regard to it. He said—"Mr. Chatham appeared to prove that discontinuances had rather a favourable influence on the future rate of mortality of a company. He admitted, however, that his investigations were not conclusive, owing to the observations upon which they were based being out of date." If Mr. Fulford would refer again to his (Mr. Chatham's) essay, he thought he would find that there was no ground for the admission referred to. He had looked at the discussion which followed the reading of the essay to see whether he had in any way modified the conclusion at which he had arrived, but he found that instead of doing that he emphasized it. He said there: "So far as the first ten years of insurance are concerned, my conclusion is clearly stated that the rate of mortality is not injuriously affected by withdrawals." He might say that when he commenced the essay he expected to prove the opposite, but he found facts too hard for him. Mr. Fulford had re-stated the old arguments, but a great advance in their knowledge of the subject had been made since he wrote his essay, to which no reference had been made by the author. To enable the members to follow him, he should like very briefly to recapitulate the state of matters. Dr. Sprague analyzed the experience of the Institute in 1870, and published the results in a paper (*J.I.A.*, xv, 328). He found that when the per-

centages of the expected deaths by various tables to the actual deaths were ranged according to years of insurance, they rapidly attained a maximum and then diminished, and he could account for that in no other way than the injurious effect which withdrawals had upon the rate of mortality. Dr. Sprague frequently expressed the opinion, and in the discussion which followed the reading of the essay, repeated it. He said: "He wished to draw special attention to the undeniable fact which appeared in the new tables now examined by Mr. Chatham as well as in those formerly examined, namely, that for any age at the time of observation or age attained, the rate of mortality first increased to a maximum with the duration of the insurance and then diminished. That undeniable fact could only be explained and accounted for by the lives which withdrew being on the whole better than those which remained." Mr. Macaulay, however, in a letter in 1895 in the Thirty-second Volume of the *Journal*, showed that that feature was in all probability due to the table of mortality used in calculating the expected deaths, and that it was possible to obtain a maximum by adding together individual groups in none of which a maximum appeared, and, as a matter of fact, he took certain of the groups which Dr. Sprague had given and in which no maximum appeared, added them together, and produced a maximum. Dr. Sprague, in his reply, in the same volume to which Mr. Besant had referred, admitted the force of Mr. Macaulay's remarks, but contended that when the comparison was restricted to a small interval of age, such as five years, the results would not be affected. He went on to say, "the law of the figures being such as I have described, it is a wholly different question how this law is to be explained. In 1870, I showed how the law might be accounted for as the effect of the withdrawal of healthy lives, and I believe that its existence proved that the lives which withdraw are, on the average, better than those which remain. I now entertain considerable doubt on this point. Mr. Chatham claims to have shown that, where the withdrawals are most numerous in the early years of insurance, there the mortality is lightest, and he concludes that in ordinary circumstances the rate of increase in the mortality during the ten years after insurance is independent of the rate of discontinuance. One of the facts on which he relies is that, on comparing the experience of the ten Scotch offices with the total experience collected by the Institute in 1863, the rate of withdrawal in the Scotch experience was less than in the total, of which it formed a part; but the rate of mortality was nevertheless higher. Mr. Chatham's conclusion, if correct, is of great importance, but the difference between the rates of mortality in the Scotch and in the total experience is small, and the conclusion seems to me to require confirmation from other sources before it can be accepted without reserve." That was one of the most important pronouncements on the subject that had been made. and was especially valuable as coming from Dr. Sprague, who had hitherto been recognized as the leading exponent on the other side. Mr. Fulford stated that the mortality among lives withdrawing could not be ascertained, because when they withdrew they were lost to observation and there were no means of tracing them; but he (Mr. Chatham) indicated in his essay one or two ways in which that could be done—for instance, by taking policies



which had been purchased by reversionary companies instead of being surrendered. It was quite true that in some cases they might know a good deal about the health of the parties selling their policies, but, he thought, as a rule they did not. At any rate, insurance companies were in a better position to obtain information regarding the health of a man who was surrendering his policy than a reversionary company. He believed that method had been actually adopted in one instance, and the result showed that the lives which in the ordinary course would have been withdrawn were worse than those which remained. As he indicated, however, in his essay, the profit now went to the reversionary companies and not to the insurance companies. Turning to the surrender-values, the author proposed to allow for age at entry thirty; he found that his method brought out 1s. 2d. for £100 policy three years in force on a 3 per-cent basis, and on a 4 per-cent basis he proposed to charge the policyholder 7s. 6d. for the privilege of surrendering his policy. The amount paid in premiums was £7. 10s. 5d., and the net risk £1. 18s. 11d., which left £5. 11s. 6d. Deducting £2 for initial expenditure and 10s. for renewal expenses, there was £3. 1s. 6d. at his credit. Similarly, if a policy was taken five years in force there was about £6 at his credit, out of which Mr. Fulford proposed to pay £2. 9s. 10d. on a 3 per-cent basis, or £1. 13s. 3d. on a 4 per-cent basis. He thought the statement of Mr. Fulford's case bore its own condemnation, and showed that there was something wrong with the method. The explanation was not far to seek; indeed it had been referred to already. Mr. Fulford had made two deductions—one for initial expenditure, namely, the replacing of the policy, and the other for general expenditure, that is, loss of contribution to the current general expenses. But it was obvious that if the policies were replaced the second was not incurred. The author seemed to have some doubts on the subject, but he thought there could be no question about it. It was a double deduction, and one must elect which of them should be taken. Before satisfactory results could be arrived at with regard to surrender-values, the matter would have to be looked at from a different standpoint, what had been called the practical or commercial point of view. A company sold sums payable at death and purchased sums payable at death in the shape of reversions. The reserve made for the former was generally at 3 per-cent interest, and the yield expected on the latter generally  $4\frac{1}{2}$  per-cent. It was desirable, as had been pointed out, to base the values allowed for surrender on the same table of mortality as was used in calculating the reserve, and regard ought to be had to the one in fixing the other. If the reserve was made on the  $H^M$  3 per-cent, the  $H^M$   $4\frac{1}{2}$  per-cent table was a very suitable one to use. If it was assumed that the first premium was swallowed up in expenses, the following values were obtained, which were almost identical with those published by Dr. Sprague in his paper on "The Construction and Use of a Select Mortality Table" in Volume xxii of the *Journal*, and given by Mr. Fulford in his paper:—

Duration	AGE AT ENTRY					
	30		40		50	
	$H^M$ $4\frac{1}{2}\%$	Sprague	$H^M$ $4\frac{1}{2}\%$	Sprague	$H^M$ $4\frac{1}{2}\%$	Sprague
3	1·873	1·867	2·868	2·953	4·271	4·275
5	3·876	3·861	5·924	5·995	8·702	8·742
10	9·378	9·590	14·081	14·158	20·266	20·246
20	23·176	23·480	32·874	32·931	43·799	43·277
30	39·979	40·215	52·686	52·299	—	—

He thought it was to Mr. King that the  $H^M$   $4\frac{1}{2}$  per-cent values were really due. When surrender-values arrived at from what might be called the theoretical point of view agreed so closely with those arrived at from a practical point of view, he thought they might be safely adopted. The only cases in which they did not work well, as had been pointed out, was in the case of limited payments by a small number of payments and short term endowment assurances. Mr. Fulford seemed to object to a policyholder having any individual rights in the reserve against his policy, and to a surrender-value being guaranteed, but he failed to see why an office should not guarantee a surrender-value as well as the sum assured. Mr. Fulford had said that when it came to a surrender of a policy the policyholder was seldom content, however liberal the surrender-value. Nothing short of the return of the whole of the premiums paid would really satisfy him, even if he did not expect interest in addition, and it seemed hopeless to give satisfaction to the policyholder in that matter. He (Mr. Chatham) had had a good deal to do with the public, and his experience was different. He had frequently found that when they were fairly dealt with, and the matter fully explained to them, they were very reasonable indeed. He thought it was their duty to educate the public in that respect, and to do everything in their power to remove the impression that an office was making a good thing out of the surrender of a policy.

Mr. FREDERICK BELL, referring to the author's remarks with regard to the Massachusetts Law, said he had not been able to learn what was "the future contribution to mortality" mentioned in that enactment. He had been told that it was the value of the future term insurance. In the case of a whole-life policy that would be the present value of the reversion. If he had been correctly informed, he suggested that it did not appear to be a fair way of calculating the contribution to mortality, which would appear to be more properly the reversion-value for the average class of lives, that is, after selection had disappeared, less the reversion-value for the select lives. That was a very small proportion of the former value, between  $1\frac{1}{2}$  or 2 per-cent of it. On the general question of selection, he was well aware of Mr. Chatham's paper, but he found it rather difficult, in the face of actual experience, to think that discontinuants were select lives. He was very much impressed with Mr. Hardy's paper (*J.I.A.*, xxiii, 1), which gave the results of an investigation into the mortality of bonus policyholders, and one result which seemed to

him personally to be very important was that of policyholders who transferred from one form of bonus to another; those who transferred into the class which took the reversionary bonus showed a much higher rate of mortality than the cash bonus and reduction of premium classes. The figures were respectively 98 per-cent for those who transferred from other classes into the cash bonus class, 115 per-cent for those who transferred from other classes into the reversionary bonus class, and 89 per-cent only for those who transferred from other classes into the reduction of premium class. That would seem to point to a very strong selection against an office. He admitted that Mr. Chatham's figures contradicted that impression, but it was an impression formed from experience of discontinuants in office work, and not from statistics. There certainly seemed a strong power of selection against an office by one class of people who were seldom if ever allowed to discontinue, namely, people who had drifted into intemperate habits. He did not think an office often had a chance of getting such an assurance off its books. He personally remembered one instance where an assured life had given way to intemperance, and that man's friends impressed the office with the fact that unless a good surrender-value was given they would club together and pay his premiums. A large value was given and the policy surrendered. One point mentioned in the discussion was as to the surrender-values of paid-up policies, where the paid-up policy was itself based on a surrender-value, showing a lower surrender-value than that which the policyholder could have taken if he had surrendered prior to converting his policy into a paid-up policy. He personally met that difficulty by basing the paid-up policy, not upon the surrender-value, but upon a modified surrender-value. It did not seem to him that a man who was not leaving the office, but merely transferring from one form of policy to another, was departing from his contract to such an extent as to justify his being fined for doing so. Therefore he used what he thought a very practical method of adjusting the surrender-value on which to base the paid-up policy.

On the motion of the President, a hearty vote of thanks was accorded to the author for his paper.

Mr. FULFORD, in reply, said it seemed to him that if an office went into the Mart and competed for the purchase of its own policies it was violating the principles upon which the business should be conducted. In valuing a policy for purchase in the market it was usual to use a rate of interest of about 4 or  $4\frac{1}{2}$  per-cent, and to include the value of future bonuses at a rate which it was considered the office might safely be expected to earn. He did not think that an office was justified in thus investing in its own future profits. All the policies in an office purchased by itself would be cancelled, and they could not, therefore, be said to contribute anything to the future profits. A further point to be considered was that if the policies were purchased by third parties they would in all probability be continued to their natural termination, and the office would thus retain the benefit of the larger membership, and its connections would be increased. Mr. Besant had asked how the select functions

had been obtained. Dr. Sprague's Select Life Tables gave the select term annuities and the whole-life annuities, so that it was not a difficult or laborious matter to calculate the tables of policy-values required. Mr. Chatham charged him with having misrepresented him. If that was so, he could only express his regret. He could not help thinking Mr. Chatham had been rather fortunate in satisfying his policyholders so completely. His (Mr. Fulford's) experience was that it was a very difficult matter indeed to satisfy them.

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## INTERNATIONAL CONGRESS OF ACTUARIES, 1900.

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WE gave last October (*J.I.A.* xxxv, 84) the Programme and Regulations of the Third International Congress of Actuaries, to be held in Paris from the 25 to the 30 June next. Mr. Ernest Woods, of 28, King Street, Covent Garden, London, W.C., the Hon. Secretary of the Congress for the United Kingdom, now kindly contributes the following interesting particulars of the most recent arrangements, which we are sure will be useful to our readers.

[Ed. *J.I.A.*]

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DEAR SIR,—It may perhaps be of interest to the readers of the *Journal* to know the present state of the arrangements for the approaching Congress.

About 100 English Actuaries have become Members of the Congress, but only about one-third of this number will be able to attend in person. It is hoped that many more will yet join, and pay the small subscription of 16s., which will entitle them to receive, free of charge, the volume of Transactions, which will be published under the authority of the Organizing Committee in Paris. The latest date for receiving names is the 31st of May.



The Council of the Institute of Actuaries have appointed as Official Delegates to the Congress, the then President, the Ex-President, the Vice-Presidents, the Treasurer, and the Hon. Secretaries, all of whom hope to be present. The following gentlemen have kindly consented to act as "rapporteurs" for the five subjects set down for consideration, namely, Mr. F. G. P. Neison on Insurance against Invalidity, &c.; Mr. G. H. Ryan on Methods of Valuation, Distribution of Surplus, &c.; Mr. J. Chatham on Mortality in Various Countries, &c.; Mr. A. R. Barrand on Mortality in Various Occupations, &c.; and Mr. W. Hughes on Valuation of Negotiable Securities, &c. The valuable papers written by these gentlemen have already (with one exception) been forwarded to Paris.

The Organizing Committee in Paris have also arranged for the compilation of a short History of Actuarial Science in each country represented at the Congress, and Mr. G. M. Low has executed the task for Great Britain. His contribution, which has already been sent to Paris, is a most valuable one.

Members of the Congress will be glad to hear that the French Railway Companies have consented to take them from the Frontier to Paris at half the usual fares, on production of a special ticket which can be obtained from the Organizing Committee in Paris. If it could be arranged for a party of 30 to travel together, the South Eastern and Chatham & Dover Railway are prepared to give a first-class return ticket, viâ Calais or Boulogne, for £2. 18s. 4d., as against the usual charge of £4. 14s. 9d., by the 2.45 or 9 p.m. trains. It is feared, however, that any arrangement of this kind would be impracticable.

To Members of the Congress and their wives, the London, Brighton and South Coast Railway will issue first-class return tickets, viâ Newhaven, at £1. 19s. 3d., or second-class tickets at £1. 10s. 3d. These tickets will be available for fourteen days by either day or night service, but application would have to be made a few days beforehand, and it would be a *sine quâ non* that a certain number of members should avail themselves of the privilege.



For the accommodation of Members, Messrs. Thomas Cook & Son, who on application will give particulars, have completed arrangements with several selected Hotels, at rates varying from 8s. 6d. to £1 per day, providing for MEAT BREAKFAST, TABLE D'HÔTE DINNER, BED, LIGHTS and SERVICE.

Monsieur Léon Marie, of 5 Rue Las-Cases, Paris, has kindly looked through the list, and thinks the prices are reasonable, but he will be happy to look out for lodgings (not in hotels) if Members will communicate with him at once, stating the prices they are prepared to pay, and the accommodation they require.

Yours faithfully,

ERNEST WOODS.

*To the Editor.*

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Since the foregoing was set up in type, Mr. Woods has sent us the following letter from M. Marie, giving some additional particulars.

[ED. J.I.A.]

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PARIS—5 RUE LAS-CASES,

15 April 1900.

*To Mons. E. Woods.*

SIR,—Many Members of the Congress from all parts of the world have written for information as to hotels at which to stay during the Congress week. The question is a somewhat delicate one, as it is impossible to suit all tastes,—but I do not like to leave it unanswered.

I have been in communication with a quiet but comfortable hotel, near the “Palais des Congrès”, of which the proprietor has promised to do everything in his power for those of our colleagues

who will write to him. Enclosed is a prospectus, which I trust you will make known among your friends.\*

It must be clearly understood that, although I send you this information, I am not in any way responsible in the matter, and friends who desire to take advantage of it should write as SOON AS POSSIBLE *direct to the Hotel, mentioning that they are Members of the International Congress of Actuaries.*

Accept, Sir, the expression, &c.,

(Signed) LEON MARIE,

*Secretary.*

P.S.—Allow me to remind you that I ought to receive, before the end of May, the names of members of the Congress who desire to make use of the reduction in fares granted by the six principal Railway Companies, with the name of the frontier station by which they will enter France. Later on they will receive the necessary pass.

\* The hotel referred to is Hôtel Clément Marot, 7 Rue Clément Marot, Champs Elysées. Members of the Congress will be received "en pension" at from 20 francs per day for a minimum of five days, or other arrangements may be made.

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## JOURNAL

OF THE

## INSTITUTE OF ACTUARIES.

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*Increasing Reversionary Charges.* By WILLIAM BROCKIE  
PATERSON, F.F.A., A.I.A., *Assistant Actuary of the*  
*Norwich Union Life Insurance Society.*

[Read before the Institute, 29 January 1900.]

SOME years ago I had the privilege of reading a paper on Contingent Reversions, &c., before this Institute, and the proposals I then made for the treatment of the premiums on the insurances to be set up in connection with reversionary transactions were received with general condemnation, nor have they since, so far as I know, met with any practical support, although I have seen no reason to alter my opinion of the soundness and practicability of the views I then put forward. I am not afraid on this occasion of meeting with like opposition, as the methods I am now going to deal with have been carried into practice already by the Society with which I am connected, and by way of reassurance, if not otherwise, have examples on the books of many of the life offices, both in England and Scotland.

It is the commonest experience in lending on reversions to be asked to lend as large a sum as it is possible for the borrower to raise on his entire interest, and I may as well admit at the outset that the requirements of this class of borrower cannot be met by any system of increasing reversionary charges, nor is the case of a sale outright within the scope of this paper. There are, however,

reversioners—and they are usually of the best class—whose encroachments on their reversionary interests are not the result of unreasonable extravagance, and whose expectations justify them in occupying positions and undertaking responsibilities for which their present incomes are inadequate, and it is with the object of explaining methods which may suit some of these cases that I have written this paper. There is, perhaps, no investment more suitable for a life office than an advance upon the reversionary interests of a reversioner of this class, although the negotiations are apt to be long and troublesome, and a great amount of labour may be involved before the transaction is put upon the books, while there is always the danger, up to the signing of a preliminary contract, and even after that stage has been passed, of the negotiations being broken off altogether. In transactions of the class indicated, no payment of interest or premium can be looked for while the life-tenant survives, and arrangements must be made accordingly. In some cases it may suit the reversioner to take a loan with provision for its rolling up, but this usually involves the introduction of a limit of time, after which, if the life-tenant is still living, the reversioner's position may become serious. On the other hand, he may obtain the money required by granting an equal reversionary charge upon his reversionary interest with the chance of repenting his contract almost immediately after it is signed. Arranging the transaction by means of increasing reversionary charges is a medium course which I believe is likely to prove very attractive to reversioners whose circumstances are such as have been referred to above, especially when the interest to be charged is a reversionary life estate.

The first case in order of simplicity is that of an absolute reversion, the second that of a contingent reversion, and the third that of a reversionary life interest, and I propose to deal with them in this order, the more so as the formulas for the first will serve as steps to those for the second, and those for the second similarly as steps to those for the third.

In all three cases it will usually be found expedient to fix a limit to the number of increases of the reversionary charges, and this limit must always be decided upon with due regard to the ages of the life-tenant and reversioner, and the relations of the increases to the initial charge and to each other must be regulated by the amount of the fund in reversion and the requirements of the reversioner.

Representing the payment to be made to the reversioner by the letter X, the initial reversionary charge by the letter K, the increases by the letter I, and the number of increases by the letter  $n$ , we have for an absolute reversion the following very simple formula, which, I think, requires no demonstration :

$$(A) \quad X = \left[ \frac{KM_x + I_1M_{x+1} + I_2M_{x+2} + \dots + I_nM_{x+n}}{D_x} \right]$$

reducing when all the increases are of equal value to

$$(B) \quad X = \left[ \frac{KM_x + I(R_{x+1} - R_{x+n+1})}{D_x} \right]$$

It will be seen that even in the reduced form there are two unknown quantities, K and I, and before a solution can be obtained, a value must be given to one or other, or a relation between them fixed. In fixing this value or relation, as also in deciding upon the number of increases, the requirements of each case must be considered by itself, the principal points to be kept in view being, as already stated, the ages, the margin to be retained in the security over the maximum reversionary charge, and the wishes of the reversioner. The table of mortality and rate of interest must be chosen with the view of making the investment sufficiently remunerative to the office, and in all the formulas in this paper the terms to which this remark applies have, to make the intention clearer, been placed in square brackets [ . . . . . ] as above.

The great majority of offices have, I believe, set aside Jellicoe's method of valuing reversions, and there is, moreover, less reason for setting up an annuity when the reversionary charge is increasing than when it is level; at the same time, it may be thought advisable, especially in very large cases, to provide for an office annuity after the maximum charge has been reached, and the formula corresponding to (B) giving effect to this will be as follows:

$$(C) \quad X = \left[ \frac{KM_x + I(R_{x+1} - R_{x+n+1}) + (K + nI)(D_{x+n} - M_{x+n})}{D_x} \right] \\ - \frac{i(K + nI)(M_{x+n+1} + \frac{1}{2}M_{x+n})}{D_x}$$

In this formula the investment portion takes the form of an increasing endowment insurance, from which must be deducted the office price of an annuity, to pay interest at a reasonable rate for the remainder of the life of the life-tenant after the maximum



charge has been reached with proportion to the day of his death. This interest must be reckoned on the maximum charge to which the investment on the books will, by the ordinary processes of addition of interest and revaluation, have been allowed to approximate by the end of  $n$  years.

When the reversioner's interest is contingent on his surviving the life-tenant, joint-life values must be substituted for the single-life values in the preceding formulas, and the present value of the premiums, or preferably the office single premium, for an increasing survivorship insurance, must be deducted.

With the reversioner represented by  $x$  and the life-tenant by  $y$ , the formulas for a contingent reversion will be

$$(A) \quad X = \left[ \frac{KM_{xy} + I_1 M_{x+1, y+1} + I_2 M_{x+2, y+2} + \dots + I_n M_{x+n, y+n}}{D_{xy}} \right] \\ - \frac{KM_{xy}^1 + I_1 M_{x+1, y+1}^1 + I_2 M_{x+2, y+2}^1 + \dots + I_n M_{x+n, y+n}^1}{D_{xy}}$$

reducing, when all the increases are of equal value, to

$$(B) \quad X = \left[ \frac{KM_{xy} + I(R_{x+1, y+1} - R_{x+n+1, y+n+1})}{D_{xy}} \right] \\ - \frac{KM_{xy}^1 + I(R_{x+1, y+1}^1 - R_{x+n+1, y+n+1}^1)}{D_{xy}}$$

and becoming, when effect is given to the provision for an office annuity to pay interest on the maximum charge for the remainder of the joint lives after that maximum is reached,

$$(C) \quad X = \left[ \frac{KM_{xy} + I(R_{x+1, y+1} - R_{x+n+1, y+n+1}) + (K+nI)(D_{x+n, y+n} - M_{x+n, y+n})}{D_{xy}} \right] \\ - \frac{KM_{xy}^1 + I(R_{x+1, y+1}^1 - R_{x+n+1, y+n+1}^1)}{D_{xy}} \\ - \frac{i(K+nI)(N_{x+n+1, y+n+1} + \frac{1}{2}M_{x+n, y+n})}{D_{xy}}$$

I may point out here, that if the insurance is, as I believe will be found usually to be most convenient, effected by a single premium, care must be taken that the initial reversionary charge exceeds the total of the purchase-money and such single premium, and that the increases are not erratic beyond certain limits, in order that the investment may be well protected.

In the case of a reversionary life interest, I think it will be found that the best results can be obtained by dividing the whole period under consideration into two parts, the first running for

the whole duration of the joint lives, and the second for the remainder of the life of the reversioner. The insurance on the life of the reversioner should in this view be resolved into an increasing survivorship insurance covering the risk of the reversioner predeceasing the life-tenant, and a level insurance for the remainder of the life of the reversioner after the death of the life-tenant, subject to adjustments arising from the desirability of putting limits upon the increases of the annual reversionary charges and of the corresponding capital reversionary charges. The annual premium payable after the death of the life-tenant will be that for the reversioner's age at the date of such death with a maximum limit, and the single premium to be paid down must provide for a temporary increasing survivorship insurance extending to the time when the maximum annual premium would become payable in the event of the life-tenant's death, and in addition for the commutation of such maximum premium during the remainder of the joint lives after the expiry of this temporary insurance. The increase in the reversionary charges will cease in either of two events, whichever may happen first, either when the maximum limit is reached, or when the life-tenant dies, and both the annual charge, when once entered upon, and the corresponding capital charge at which the annual charge may be redeemed will remain constant during the remainder of the life of the reversioner. The capital and annual reversionary charges are immediately dependent upon each other, so that when the initial charge and the increases have been fixed for either, they have been settled for both. For reasons which will be obvious when the formulas are submitted, it is simpler to make the capital reversionary charges the basis of calculations, although, in the first place, in the selection of the initial charges and the increases, as well as the limits to be put upon the number of increases and the maximum annual premium in accordance with the requirements and possibilities of each individual case, the annual charges will be the best guide.

The formulas by which the capital reversionary charges can be determined are very similar to those given above for contingent reversions, changes being necessary only in the terms representing the insurance premiums. Provision must now be made, as already mentioned, for a temporary increasing survivorship insurance, for the commutation of the maximum premium for the remainder of the joint lives, and for carrying on the insurance after the death of the life-tenant at the rate for the age of the

reversioner at that time, not exceeding the maximum premium, without fresh medical examination.

The first formula will be

$$(A) \quad X = \left[ \frac{KM_{xy} + I_1M_{x+1.y+1} + I_2M_{x+2.y+2} + \dots + I_nM_{x+n.y+n}}{D_{xy}} \right]$$

$$\frac{KM_{xy}^1 + I_1M_{x+1.y+1}^1 + I_2M_{x+2.y+2}^1 + \dots + I_nM_{x+n.y+n}^1 - (K + I_1 + I_2 + \dots + I_n)M_{x+n.y+n}^1}{D_{xy}} - \frac{P_{x+n}(K + I_1 + I_2 + \dots + I_n)(N_{x+n.y+n} - \frac{1}{2}M_{x+n.y+n}^1)}{D_{xy}}$$

In this formula,  $P_{x+n}$  is the maximum premium, and the deduction of  $\frac{1}{2}M_{x+n.y+n}^1$  is made in commuting it, because the annual premium is payable as from the day of the death of the life-tenant, and without this deduction it would, in the one event of the maximum premium being reached, run from six months after the death.

The insurance on the life of the reversioner after the expiry of the temporary survivorship insurance must be carried on without fresh medical examination, and the risk of the life being under average must therefore be covered. If I had not before me the reception given to the principles of my previous paper, I would get over this difficulty by charging annual premiums for non-select in place of select lives, safeguarding the office in the event of redemption by requiring payment of the first annual premium along with the redemption price, and it is with great reluctance that I turn from this simple plan to find a single premium that will meet this risk. The single payment to cover the risk of a life aged  $x$  being in existence, but having become damaged at the end of  $t$  years, is given in the introduction to Dr. Sprague's Select Tables,  $t$  being not less than 5 years, as  $\frac{M_{x+t} - M_{[x+t]}}{D_{[x]}}$ , but it would not, I think, be correct to say that after charging this single premium the annual premium for a select life could be accepted for an insurance from age  $x+t$ .

The single premium required if the premium  $\mathbb{P}_{[x+t]}$  is to be charged whether the life is good or damaged is

$$\frac{v^t l_{x+t}}{l_{[x]}} \left\{ \mathbb{P}_{x+t}(1 + a_{x+t}) - \mathbb{P}_{[x+t]}(1 + a_{x+t}) \right\}$$

or 
$$\frac{v^t l_{x+t}}{l_{[x]}} \left\{ (\mathbb{P}_{x+t} - \mathbb{P}_{[x+t]})(1 + a_{x+t}) \right\},$$

which in commutation symbols becomes

$$\frac{M_{x+t} - \frac{N_{x+t}}{N_{[x+t]}} M_{[x+t]}}{D_{[x]}}.$$

In the cases now under consideration, the insurance is deferred, not for a definite period, but for a life, and the sum insured is increasing in place of constant. For the year  $t$ , the single premium for deterioration appears to be

$$\frac{v^t(l_{x+t-1} + l_{x+t})d_{y+t-1}}{2l_{[x]}l_{[y]}} \{ (P_{x+t} - P_{[x+t]})(1 + a_{x+t})(K + I_1 + I_2 + \dots + I_{t-1}), \}$$

to  $n$  terms of which must be added

$$v^n n p_{[xy]} \{ (P_{x+n} - P_{[x+n]})(1 + a_{x+n})(K + I_1 + I_2 + \dots + I_n) \}$$

for the event of both lives surviving till the maximum premium is reached. It is obvious that the calculation of this single premium by such a method would be out of all proportion to its importance, and some more or less arbitrary way out of the difficulty must be adopted. I find that the values of  $(P_{x+t} - P_{[x+t]})(1 + a_{x+t})$  on Dr. Sprague's Select Tables, with  $3\frac{1}{2}$  per-cent interest, multiplied by  $v^{x+t}$  at  $3\frac{1}{2}$  per-cent, for ages 30, 40, 50, 60, and 65, are respectively .00246, .00247, .00326, .00328, and .00344, and the office cannot be the loser if a constant of .0033 is substituted for these figures. The single premium per-cent, assuming the sum insured level, can then be represented by  $\frac{.33}{v^x} \{ {}_nq_{xy}^1 + {}_np_{xy} \}$  or  $\frac{.33}{v^x} \{ Q_{xy}^1 + {}_np_{xy}(1 - Q_{x+n, y+n}^1) \}$  or  $\frac{.33}{v^x} \{ Q_{xy}^1 + {}_np_{xy} \cdot Q_{x+n, y+n}^1 \}$ , the values of which for several combinations are as follows, taking  $Q$  and  $p$  on the Carlisle Table—the only table for which  $Q$  has, I believe, been tabulated:

Ages of  $x$  and  $y$ , 30 and 50, term 25 years, .7389; 30 and 60, term 20 years, .7975; 40 and 60, term 20 years, 1.0759; 50 and 70, term 10 years, 1.632; 40 and 40, term 20 years, .9898.

These figures are necessarily very rough approximations, and are probably very considerably in excess of the results that would be obtained by accurate calculation, but they appear to show that, except when the reversioner is past middle life, a single

premium of 1 per cent. would fairly meet the risk, and that for the increasing insurances now under consideration it would be sufficient in most cases to make the charge upon the mean sum insured.

When in formula A for a reversionary life interest,  $I_1$ ,  $I_2$ , &c., are all of equal value, we get

$$(B) \quad X = \left[ \frac{KM_{xy} + I(R_{x+1.y+1} - R_{x+n+1.y+n+1})}{D_{xy}} \right] \\ - \frac{KM_{xy}^1 + I(R_{x+1.y+1}^1 - R_{x+n+1.y+n+1}^1) - (K+nI)M_{x+n.y+n}^1}{D_{xy}} \\ - \frac{P_{x+n}(K+nI)(N_{x+n.y+n} - \frac{1}{2}M_{x+n.y+n}^1)}{D_{xy}}$$

This formula, when an office deferred annuity to provide interest after the maximum capital charge has been reached is introduced, becomes

$$(C) \quad X = \left[ \frac{KM_{xy} + I(R_{x+1.y+1} - R_{x+n+1.y+n+1}) + (K+nI)(D_{x+n.y+n} - M_{x+n.y+n})}{D_{xy}} \right] \\ - \frac{KM_{xy}^1 + I(R_{x+1.y+1}^1 - R_{x+n+1.y+n+1}^1) - (K+nI)M_{x+n.y+n}^1}{D_{xy}} \\ - \frac{P_{x+n}(K+nI)(N_{x+n.y+n} - \frac{1}{2}M_{x+n.y+n}^1)}{D_{xy}} \\ - \frac{i(K+nI)(N_{x+n+1.y+n+1} + \frac{1}{2}M_{x+n.y+n})}{D_{xy}}$$

In the foregoing formulas it has been assumed that the number of increases in the capital and annual reversionary charges is the same, but it may sometimes be found convenient to introduce a more deferred limit for the annual charges, taking the maximum premium as that for age  $x+m$ , where  $m$  exceeds  $n$ , and the formulas can easily be modified to meet such a requirement. It will be sufficient illustration of this modification in all the formulas if I give the result corresponding to that last above mentioned. Introducing the new maximum premium in that formula, we get



$$\begin{aligned}
 X = & \left[ \frac{KM_{xy} + I(R_{x+1,y+1} - R_{x+n+1,y+n+1}) + (K+nI)(D_{x+n,y+n} - M_{x+n,y+n})}{D_{xy}} \right] \\
 & - \frac{KM_{xy}^1 + I(R_{x+1,y+1}^1 - R_{x+n+1,y+n+1}^1) - (K+nI)M_{x+m,y+m}^1}{D_{xy}} \\
 & - \frac{P_{x+m}(K+nI)(N_{x+m,y+m} - \frac{1}{2}M_{x+m,y+m}^1)}{D_{xy}} \\
 & - \frac{i(K+nI)(N_{x+n+1,y+n+1} + \frac{1}{2}M_{x+n,y+n})}{D_{xy}}
 \end{aligned}$$

If in this formula  $n$  is taken equal to 0, that is, if the capital reversionary charge is assumed constant, while the annual reversionary charge increases, we get

$$\begin{aligned}
 (C^2) \quad X = & K \left\{ 1 - \frac{M_{xy}^1 - M_{x+m,y+m}^1}{D_{xy}} \right. \\
 & - \frac{P_{x+m}(N_{x+m,y+m} - \frac{1}{2}M_{x+m,y+m}^1)}{D_{xy}} \\
 & \left. - \frac{i(N_{x+1,y+1} + \frac{1}{2}M_{xy})}{D_{xy}} \right\}
 \end{aligned}$$

the first and last terms of which combined make up the value of an absolute reversion on the failure of the joint lives, while the second and third terms provide for the necessary insurances.

The annual reversionary charges corresponding to the capital reversionary charges ascertained by any of the foregoing formulas for a reversionary life interest are formed by dividing these capital charges by complete annuities deduced from the annual premiums payable from the death of the life-tenant. Assuming the charge to be payable in yearly instalments, the

initial capital charge should be divided by  $\frac{1}{P_{x+1}+d} - 1 + \frac{1}{2}A_{x+1}$ ,

the second capital charge by  $\frac{1}{P_{x+2}+d} - 1 + \frac{1}{2}A_{x+2}$ , and so on, to the divisor corresponding to the maximum premium, which when  $m$  and  $n$  are equal will be the divisor both for the capital charge before the maximum and for the maximum capital charge.

By the use of the preceding formulas the outlay in premiums during the joint lives is, I believe, minimized as far as possible under existing conditions, and, as a consequence, better results should be obtained from them than would be procurable otherwise. There can, however, be no harm in stating briefly the methods to be employed when whole-life

premiums are charged from the commencement. The capital reversionary charges must again be taken as the basis of the formulas, and the first formula will be

$$(A) \quad X = \left[ \frac{KM_{xy} + I_1 M_{x+1, y+1} + I_2 M_{x+2, y+2} + \dots + I_n M_{x+n, y+n}}{D_{xy}} \right] \\ - \frac{KP_x N_{xy} + I_1 P_{x+1} N_{x+1, y+1} + \dots + I_n P_{x+n} N_{x+n, y+n}}{D_{xy}}$$

from which the corresponding formulas (B) and (C) can easily be deduced.

The initial annual reversionary charge will be found by dividing the initial capital charge by the complete annuity corresponding to  $P_x$ . For the second, the increase of the capital charge at the end of the first year must be divided by the complete annuity corresponding to  $P_{x+1}$  and the result added to the initial annual charge, and so on for the third and subsequent years until the last increase is reached, when the divisor will be the complete annuity corresponding to  $P_{x+n}$ . The question of deterioration has again to be met, but in this case there can be no objection to the premiums at age  $x+1$ ,  $x+2$ , &c., being increased to provide for insurances on non-select in place of select life, and this course would, I think, be the simplest and best to adopt.

I had some hesitation in offering this paper, because it is probable that some of the methods explained above, or better methods of carrying out the same objects, have been used by actuaries in the ordinary course of business, but I hope it will be considered sufficient justification that neither the methods nor the formulas now submitted have ever, so far as I can trace, been dealt with in any paper submitted to this Institute.

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#### EXAMPLES.

In the following examples the Carlisle Table of Mortality has been used throughout, with interest at  $3\frac{1}{2}$  per-cent for the office single premiums and annuity prices, all of which have been loaded 10 per-cent, and with interest at 5 per-cent for the investment terms, except where combined with an office annuity, and in the case of a reversionary life interest after the life interest has come into possession, when the rate is 4 per-cent. The average without-profit premiums given in Bourne's Insurance Directory for 1897 have been used for whole-life annual premiums.

In all the formulas the insurances are assumed to be effected by single payments for the term of the joint lives, and, in order that the comparison instituted below between the increasing and level charges may be on equal conditions, the ordinary formulas for level charges have been adjusted so that they also provide for insurances by like single payments.

The consideration in respect of which the charges are given is in each case assumed to be £1,000.

*Charges upon an Absolute Reversion.*

Age of Life-tenant	Formula	Initial Charge	Yearly Increase	Ultimate Charge	Corresponding Level Charge
		£	£ s. d.	£ s.	£
50	B	1,603	64 2 5 for 25 years	3,206 0	2,518
60	B	1,268	63 8 0 „ 20 „	2,536 0 }	1,899
60	C	1,280	64 0 0 „ 20 „	2,560 0 }	1,537
70	B	1,191	59 11 0 „ 10 „	1,786 10	

*Charges upon a Contingent Reversion.*

Age of Reversioner	Age of Life-tenant	Formula	Initial Charge	Yearly Increase	Ultimate Charge	Corresponding Level Charge
			£	£ s. d.	£	£
30	50	B	2,304	92 3 2 for 25 years	4,608	3,497
35	60	B	1,605	80 5 0 „ 20 „	3,210 }	2,337
35	60	C	1,617	80 17 0 „ 20 „	3,234 }	
40	70	B	1,384	69 4 0 „ 10 „	2,076	1,767

*Capital Charges upon a Reversionary Life Interest (or Redemption Prices).*

Age of Reversioner	Age of Life-tenant	Formula	Initial Charge	Yearly Increase	Ultimate Charge	Corresponding Level Charge
			£	£ s. d.	£ s.	£
30	50	B	2,547	101 17 7 for 25 yrs.	5,094 0	5,311
35	60	B	1,703	85 3 0 „ 20 „	3,406 0	
35	60	C	1,716	85 16 0 „ 20 „	3,432 0	3,038
35	60	C <sup>1</sup>	1,725	86 5 0 „ 15 „	3,018 15	
35	60	C <sup>2</sup>	2,294	...	2,294 0	
50	70	B	1,587	79 7 0 „ 10 „	2,380 10	2,474
40	40	B	7,752	387 12 0 „ 20 „	15,504 0	22,701
35	60	B with Whole-Life Premiums	2,150	107 10 0 „ 20 „	4,300 0	3,038

*Annual Charges upon a Reversionary Life Interest.*

Age of Reversioner	Age of Life-tenant	Formula	Initial Charge	Number of Increases	Ultimate Charge	Corresponding Level Charge
			£ s.		£ s.	£ s.
30	50	B	161 6	25	482 16	332 19
35	60	B	113 19	20	322 16	200 19
35	60	C	114 16	20	325 6	
35	60	C <sup>1</sup>	115 8	25	331 14	
35	60	C <sup>2</sup>	153 10	25	252 1	
50	70	B	136 2	10	261 11	207 14
40	40	B	553 7	20	1,703 5	1,600 16
35	60	B with Whole-Life Premiums	142 0	20	311 0	200 19

*The Annual Charges for the case of a Reversioner aged 35 and a Life-tenant aged 60 under Formula B.*

Year of Contract in which the Life-tenant dies leaving the Reversioner surviving	Annual Reversionary Charge	Year of Contract in which the Life-tenant dies leaving the Reversioner surviving	Annual Reversionary Charge	Year of Contract in which the Life-tenant dies leaving the Reversioner surviving	Annual Reversionary Charge
	£		£		£
1	114	8	169	15	243
2	121	9	178	16	256
3	129	10	188	17	269
4	136	11	198	18	284
5	144	12	208	19	299
6	152	13	219	20	315
7	160	14	231	Thereafter	323

## DISCUSSION.

The PRESIDENT (Mr. H. W. Manly) was sure the members would all agree with him that they were very much indebted to Mr. Paterson for his paper, and that they welcomed his contribution as a novel treatment of a subject which had been described as a hardy annual. If his memory was correct, he thought the objection that was taken to Mr. Paterson's former paper was that he proposed that some of the insurance and annuity portions of the formulas should be calculated at net rates; and although he saw no objection to the office treating a transaction in that way when it carried the whole of the assurance and the annuity portions itself, it would not be possible to obtain re-insurance on the same terms. The lending office must either pay the properly-loaded premium, or do what the late Mr. Sutton held to be the only fair and proper way, to share the whole transaction with the other companies. But that objection could not be taken to Mr. Paterson's present paper, because he

proposed to charge for the annual premiums the average non-profit premium charged by all the offices; for the single premium assurance, the Carlisle  $3\frac{1}{2}$  per-cent loaded 10 per-cent, which produced a very fair premium, and for the annuities, he understood Mr. Paterson proposed to charge Carlisle  $3\frac{1}{2}$  per-cent loaded 10 per-cent, which seemed to give a very fair rate for males, but hardly large enough for females. He would like to ask Mr. Paterson whether he did not propose to make a distinction between males and females? It seemed to him that in these transactions it affected the value very much whether the life-tenant happened to be a male or a female. He confessed that Table III puzzled him somewhat. He noticed generally that the level charge was somewhat of a mean between the initial and the ultimate charges, but the capital charges upon reversionary life interests seemed to be entirely outside Mr. Paterson's ultimate charges. It seemed curious; and although he had not been able to test it, he was quite prepared to take Mr. Paterson's word for it—that although there was that peculiar difference in the capital charges, it was consistent that the same peculiarity should not appear in the annual charges, which were shown in the next table. He thought the paper had been condensed too much. He would like to see some of it enlarged; for instance, he would like to know the best way of calculating a temporary increasing contingent insurance, and also how one was to arrive at the annual premium payable after the death of the life-tenant, for the age of the reversioner at the date of such death. No doubt there were ways of approximating to the values which Mr. Paterson used, but he thought it would help some of the members should such a problem come before them if they could have reference to what had been done before.

Mr. J. E. FAULKS thought that the hesitation referred to by the author at the end of his paper was uncalled for, and that the Institute owed him very sincere thanks for a paper which, although concise, gave considerable scope for thought. Mr. Paterson had very carefully limited the class of reversioners to which he proposed to apply his formulas, but he could not help thinking that Mr. Paterson's experience had been more fortunate than that of the majority. It seemed to him that the majority of reversioners required all they could get, if not at once, at least later on, a point which was important in considering the increasing reversionary charge. If they did not fall under that class, in general they believed, rightly or wrongly, the life-tenant to be in a very bad state of health, and under those circumstances they would be disinclined to adopt even Mr. Paterson's reversionary charges, but would prefer a sale of a level charge with an option of redemption within a certain limited time, such as was proposed by Dr. Sprague in one of his papers in the *Journal*. If one might quarrel with an expression in the paper, he did not see how in such a case the reversioner's position became serious if the life-tenant was still living. If the life-tenant was living at the end of the time when the option of re-payment of the sum advanced expired, then the reversionary charge was greater than it would have been if the transaction throughout had taken the shape of a sale; but he had



had a corresponding benefit. He thought, therefore, that in the first place it must be concluded that it could only be a very small proportion of reversions to which the formulas would be applicable. Mr. Paterson dealt with absolute reversions, contingent reversions, and reversionary life interests. With regard to absolute reversions, he (Mr. Faulks) did not think there could be any objection, theoretically, at any rate, to the formulas which the author put forward. With the exception of Formula C, the formulas were based upon the practice of purchasing an absolute reversion by  $A_x$ , strongly recommended by Dr. Sprague, although in existence long before that time. That had always been recognized as requiring two points to be considered; first, that there should be a sufficient number of cases to form an average—and he thought most actuaries if they bought reversions on those principles of increasing reversionary charges would like to have a sufficient number to form an average in themselves—and, secondly, there must not be a case so large as to upset the average, and that was of some importance in connection with increasing reversionary charges; because, when an increasing charge was dealt with, the ultimate charge would have to be considered as the amount at risk and not the initial charge. Strictly speaking, the amount at risk was not the amount of the charge, in just the same way that the amount at risk under a policy was not the amount of the policy, but the amount of strain. Still, practically, one would look at the amount in reversion. From another point of view, the increase in the amount of the charge required some little comment. The increasing charges necessitated a larger fund, or, in other words, the margin over the ultimate charge must be at least as great, proportionately, as the margin over the level charge. It was, in fact, a question whether the margin should not be greater, because the greatest charge came at the end of a comparatively large number of years when the margins which had been deducted from the investments forming the fund in order to arrive at an idea of its value might more likely prove insufficient than during the earlier years. He had noted, as had the President, that Mr. Paterson used the Carlisle Table. In the opinion of a good many actuaries, that was not altogether a suitable one to use, but that was a point that he should not like to press, because, after all, the figures were only comparative, and therefore the actual table used was perhaps not of so very much importance. There was another point in connection with absolute reversions. He questioned whether there was not a quasi-moral objection against increasing charges. The reversioner of Mr. Paterson's paper was one who was described as occupying positions and undertaking responsibilities for which his present income was inadequate. He did not know exactly what responsibilities Mr. Paterson contemplated, but those of a certain character had a habit of increasing with years, and it seemed to him that if the life-tenant lived a long time, the reversioner, when he did come into the fund, would find himself burdened with a very heavy charge at a time when he wanted all the cash available—much more burdened than would be the case if he had had a level charge throughout. It was a question whether, from that point of view, he would be compensated by the fact that

if he had come into the reversion earlier he would have had a smaller charge under that system than under the ordinary system. Passing to contingent reversions, there was the same formula as in the case of absolute reversions, but provision had to be made for increasing survivorship insurances. It seemed to him there were two practical objections to those insurances: (1) the fact that they were increasing insurances—that was, that a fresh insurance was continually being granted over a long period of years on a life that was no longer select, the increase of course being much larger proportionately than the bonus granted on “with profit” policies; and (2) that an office could not under that system retain as much at its own risk, and therefore it had to give up part of the insurance and thus part of the profit. If, for instance, the case was taken of 35 and 60 it would be seen that the level charge was £2,300. Supposing an office with a limit of £2,500 dealt with the case in that way, it retained the whole insurance. If, on the other hand, it took the increasing assurance, beginning at £1,600 and increasing to £3,200, then it would have to consider, in settling the amount it was to retain at its own risk, the ultimate amount of the insurance. It seemed to him, therefore, it would have to give up a portion of the policy, and to that extent would diminish its own profit. The question of the premium to be charged was not, perhaps, so very important, because it was only used for purpose of comparison, but it was doubtful whether the Carlisle  $3\frac{1}{2}$  contingent survivorship premium with a loading of 10 per-cent was sufficient. He did not press the point at that juncture. The option premium question was not without interest. The original problem was to find the single premium required for the option of effecting a policy  $n$  years hence at the ordinary rate for the then age. Dr. Sprague (*J.I.A.* xxii) had given a formula for that based on his unhealthy life table, and Mr. Rothery (*J.I.A.* xxviii) gave another formula equivalent to that of Dr. Sprague. Mr. Moir, also, in the *Transactions of the Actuarial Society of Edinburgh*, had given a formula substantially identical with Mr. Rothery’s, and absolutely identical with Mr. Paterson’s. Curiously enough, Dr. Sprague, in his introduction to the Select Tables, gave a different formula, but the wording used was such that one could not be absolutely certain that he had in mind the granting of a policy at an annual premium at the expiration of the term. If he had such a thing in his mind it would almost seem that this fact had been overlooked, namely, that if the annual premium for age  $x+n$  became payable it would be payable not for the remainder of the lifetime of a life select at the age  $x+n$ , but for the remainder of the lifetime of a life select at age  $x$ ,  $n$  years ago. Mr. Rothery, in his letter to the *Journal*, gave no premiums for terms longer than ten years, and considered that such premiums calculated from available materials would probably be misleading. Mr. Moir, in the *Transactions of the Actuarial Society of Edinburgh*, came to the conclusion that the existing tables were not sufficiently accurate to allow of these options being properly calculated. He also gave some values deduced from Mr. King’s analyzed tables, which were generally considerably higher than those deduced from Dr. Sprague’s tables. He (Mr. Faulks) thought the President, in a discussion at the

Institute, considered that eighteen years was a very long time for which to grant such an option; and another distinguished member of the Institute had said he would very much hesitate to recommend the acceptance of proposals for issuing policies at the expiration of such a term as eighteen years, and in the present state of actuarial opinion he considered such business impracticable. Bearing all that in mind, it seemed very doubtful whether one was justified in making use of the option premiums of Mr. Paterson, calculated admittedly in a less accurate manner than those for a fixed term of years by Mr. Rothery in the *Journal*. He had only one more word to say, and that was in connection with the reversionary life interests. He might suggest as a point of detail that possibly the formulas would be improved if some reference were made in them to the fact that the option premium had to be deducted. He had noted that in looking at the absolute and contingent reversions a sort of check was formed upon the accuracy of the calculations by observing that the level charges were approximately in all cases the average between the initial charge and the ultimate charge of the increasing charges. But looking at reversionary life interests, particularly the case pointed out of forty and forty, it would be found that that was very far from being the case. If, however, one or two of the calculations were gone into it would be seen that the reversion term still more or less followed the rule, but it was the insurance terms where the change came in. In the case of forty and forty there was a corresponding level charge of £22,701, where the ultimate charge was £15,504. The explanation of such figures, he thought, must be due to the way the insurances had been treated. It seemed to him there were three points which might influence the figures. The first he had already mentioned, that one could not be sure that a sufficient premium had been charged for the option to take out the deferred insurances at the maximum premium. Secondly, the Carlisle  $3\frac{1}{2}$  per-cent with 10 per-cent loading was used for the temporary contingent survivorship policy which formed a large portion of the insurance necessary. It was very doubtful if that was sufficient, and the comparison was not being made, as it was in the case of a contingent reversion, with a premium calculated in a similar way, but was being made with actual whole-life premiums taken from Bourne's Insurance Directory. Therefore, it was important that for the temporary increasing contingent survivorship policies the premium should correspond in its general lines with the premiums actually charged for non-profit whole-life policies. Thirdly, and most important of all, he thought that the difference in the figures was due to the fact that in treating the insurances in the way Mr. Paterson suggested, a very large portion, if not the whole, of the loading on the ordinary whole-life non-profit policy was sacrificed. Mr. G. F. Hardy had alluded to the question when a similar proposition came before the Institute about two or three years ago, and that seemed to him (Mr. Faulks) to be the explanation why the charges were so very favourable to the reversioner. Mr. Paterson called them the best results—they were best no doubt for the reversioner, but whether they were best for the office was another matter. In that connection it should not be omitted to note that in



the case of the corresponding level charges it was at any rate a question whether the surrender-value of the whole-life policy should not be allowed on redemption. He thought the better opinion was that it should be. That would tend, so far as it went, to reduce the apparent discrepancy between the figures—only then the office did preserve the profit between the reserve and the surrender value, whereas under the suggested mode of treating the assurance it lost the greater part of it.

Mr. R. R. TILT said that one of the principal objects of the essay was to put before the Institute a system of increasing reversionary charges by means of which the loss to the reversioner in the event of the early death of the life-tenant would be reduced, whilst there would be a corresponding reduction in the loss to the purchaser, if the existence of the life-tenant should be unduly prolonged. The great objection to these increasing reversionary charges came, he thought, from the side of the reversioner, and consisted in the unsatisfactory condition in which it left the residue of his security. Whatever the circumstances of the reversioner might be, there was a strong probability that, having had one advance on the security of his reversion, he would before long ask for a second, to be followed at intervals by a third and a fourth, and so on, until at last, perhaps, his whole reversion had disappeared. Under the level charge system these transactions presented no difficulty, but directly he had obtained an advance on the increasing system, he had left a decreasing reversion, and after two or three of those advances, it might easily be that he had remaining a reversion to a substantial sum, decreasing by irregular steps to zero, a security that he thought would be absolutely unmarketable. His difficulties would be considerably increased in the case of contingent reversions and reversionary life interests. It must be remembered that the reversioner had no option of re-arranging his security as in the case of accumulating loans. The consequence was that if a reversioner disposed of his reversion by instalments, he would get a much bigger sum in cash by the level method than by Mr. Paterson's method. With regard to the discussion of the various formulas suggested for the valuation of reversionary interests, he thought they might conveniently be considered in connection with three distinct elements of risk against which the purchaser must be safeguarded. The first was the loss of interest if the life-tenants lived on the average beyond the expectation shown by the mortality table. That risk was common to all three classes, and it was the only risk incurred in the purchase of an absolute reversionary sum. As the method of increasing the charge with the age of the life-tenant tended to reduce that loss, the formulas of the paper for an absolute reversion might be accepted from an actuarial standpoint. The second element of risk was the loss of capital when the probability that  $x$  would die before  $y$  was greater than the mortality table anticipated. That loss might occur from one or both of two causes. The vitality of  $x$  might be inferior to that shown by the table, or  $y$ , by living beyond his expectation, might increase the term for which the life of  $x$  was assured. That risk was common to both contingent reversions and reversionary life interests, and, as it was a risk of loss

of capital, it would be a reckless proceeding on the part of the purchaser to assure it at a net premium, even if he had reliable data on which to base his premium. It was necessary to calculate the reasonable net premium and then load it for all contingencies, including occupation and residence. Recent events had shown how soon in the case of a national emergency civilians might be called upon to incur hazardous risks on behalf of their country. Their patriotism could be fully appreciated, but it was necessary for the offices to protect their monetary interests. If the Carlisle Table was used in the calculation, it was known that there was a large amount of evidence in existence culminating in the recently published Institute Annuity Experience, showing that at the older ages the vitality of the lives was under-estimated, especially for females (and he thought females formed about 80 per-cent of the life-tenants in the case of the reversions that came into the market), whilst there was no evidence of any compensatory discrepancy in the annuity-values at the younger ages from which the reversioners were drawn. He confessed to a considerable doubt as to the adequacy of the premiums used in the examples given in the paper. He had calculated by the Carlisle Table, using actual ages, no premium loading, and 5 per-cent interest throughout, the value of one of the examples, and he found on that basis the value came out at £1,065. This £65 was the only margin to cover the risk of loss of interest (under heading 1) and to cover the risk of the loss of a capital of £2,000 or £3,000 (under heading 2), if the probability that  $x$  died before  $y$  was greater than that shown by the Carlisle Table. He thought 2 per-cent on the maximum sum insured was a very inadequate charge for these risks. Then there was a third element of risk, which applied only to the reversionary life interest—it was the loss of annuity payments that would be incurred if  $x$  survived  $y$ , but  $y$ , the life-tenant, lived beyond her expectation. That was a totally different risk from No. 2. If the life-tenants on an average lived beyond their expectation, then it was certain that the purchasers of the reversionary annuities would, on an average, receive a smaller number of annual payments of the annuities. If  $y$ 's expectation was 3 years greater the purchaser would, on an average, receive three years' fewer payments of the annuity. It was for that reason that he was an advocate of Jellicoe's method of valuation of such securities. By giving a higher value to the joint life annuity in the formula

$$\frac{1}{P_x + d} - (1 + a_{xy})$$

allowance was made for that risk of loss. A higher annuity was charged than that at the investment rate, and therefore allowance was made for the risk of not getting all the payments expected at the end of the term. If the investment rate of interest was used, no such allowance was made; and it was that element of risk that the author's formula left out of account. Mr. Paterson did not say definitely that he proposed to apply it to a level or constant reversionary annuity, but, if it was so applied, then he left that element out of account altogether. The method adopted in the



paper was to treat the security as a contingent reversion to a capital sum, and, when that amount became payable, the annuity was fixed so that it should provide both the interest on the amount and the premium at  $x$ 's attained age for a whole-life assurance. If formula  $C^2$  was looked at, it would be found that the reversionary capital charge was constant or level—and the reversionary annuity was consequently increasing. Of course, if the reversionary capital charge, or what he was sorry to see Mr. Paterson called the redemption money, increased, the reversionary annuity increased still more, and it followed that, if the reversionary annuity was constant, the capital charge decreased. There was no example of this case in the paper, but the application of the formula showed the transaction as the purchase of a contingent reversion to a diminishing amount, and the author made no allowance in the formula for the risk that if  $y$ 's life was unduly prolonged, the sum received would be less than was anticipated. He should like to say a few words as to the redemption money, and he thought he could explain the great discrepancies to which the President had called attention. Although in consequence of the different methods of adjustment used in the two formulas, the new one was inadmissible, as he thought, in the valuation of a level reversionary annuity, he was prepared to admit that where there was a reversionary annuity equivalent to a constant capital sum, there was an allowance made for that third element of risk. Turning to the two formulas given in the *Text-Book* for the value of reversionary annuities (*Text-Book*, Part II, pages 245 and 249), it would readily be seen that, if it were permissible to buy these reversionary annuities at net rates, or rather at their gross values—as, for example, by a mortality table that could be considered absolutely safe,—the two formulas would give identical results for a reversionary annuity of 1 per annum. The first expression was  $a_x - a_{xy}$ , which converted into a market value became

$$\frac{1}{P_x + d} - (1 + a_{xy}).$$

where  $P_x$  was the office premium for an assurance on  $x$ 's life and the redemption money was

$$\frac{1}{P_x + d} - 1.$$

The other expression was

$$\sum v^t \frac{l_{x+t}}{l_x} \frac{d_{y+t-1}}{l_y} (1 + a_{x+t}),$$

which converted into a market value became the value of a contingent reversion to a diminishing sum, namely—

$$\frac{1}{P_{x+t} + d},$$

and the redemption money was

$$\frac{1}{P_{x+t} + d} - 1,$$

which at its maximum was less than the redemption money by the ordinary formula, and as  $x$ 's age increased it gradually decreased. It could easily be shown that the difference between the two redemption prices was the re-insurance or hypothetical value of the whole-life policy that the old formula set up. That brought up the old contention, that on redemption of the security the policy should be handed over to the reversioner. The strong objection to that course was that it enabled the reversioner to take advantage of any change in the Money Market to transfer his security or insist upon a reduction in the annuity, thus depriving the original purchaser of a portion of the benefit which he expected to obtain when he bought the annuity. Twenty or thirty years ago those securities could have been bought to pay 6 per-cent or 7 per-cent. A young reversioner then was only 50 or 60 now, and he could probably now borrow at, say, 2 per-cent less on the policies, combined with his life interest—the office when it took the contract settled the price on the understanding that it was to have the higher rate when the security came into possession. Was the reversioner now to be given the option of deducting 2 per-cent from the benefit purchased by the office? Mr. Paterson, however, went much further than that. He said that such a cash adjustment must be made on redemption as to surrender not only the profit from interest (if any) but also the difference between the office premium at the age  $x+t$  and the 4 per-cent net premium of that age. The author said that because two events had happened favourable to the purchaser (namely, that  $x$  survived  $y$  and was in good health), that therefore the purchaser must give up a large part of the margin for contingencies that he allowed for when he made the investment. That was an *à posteriori* argument, which the Institute in its *a priori* wisdom would unanimously reject. If Mr. Paterson's system of increasing reversionary charges was ever adopted in practice the irreducible minimum for the redemption price should be the amount of the annuity multiplied by the 3 per-cent annuity-value, *i.e.*,

$$\frac{1}{P_{x+t}+d} \text{ (net values).}$$

Mr. JAMES CHISHOLM threw out a suggestion with regard to the particular borrowers or vendors that Mr. Paterson had in view. Mr. Paterson spoke of them as being those who had such an abundant margin of security, and whose future expectations were so much in excess of the present requirements, that they needed exceptional treatment. He (Mr. Chisholm) had not met with any of that class himself, and thought they must be very few in number. When, however, they were met with, why could they not be met in the way introduced by Dr. Sprague? A man gave security or sold a portion of his future expectations, and one was willing to do the best for him, as the security offered was so large. He was given an option of redemption for, say, 5 years. In that way he paid his money back with an agreed rate of interest, which was fixed so as to afford sufficient profit to the lender. But if the borrower had such a large amount of security in the future to offer, the office

could perfectly well say to him, "Come to us again at the end of five years and we will advance you the money to pay us off, and we will make another bargain with you subject to your passing another medical examination." A fresh purchase could be made with a freshly calculated fixed charge, and another option given for five years. That could be done two or three times until the borrower had got to the end of his tether and there was no sufficient margin available. If there was a case where a borrower or vendor had such superabundant expectations as to afford that being done, why not do it in that way, and arrange by separate agreements at the outset for all these recurring options. It would get rid of all the difficulty of entering into a fixed term transaction extending over 10, 15, or 20 years and increasing the insurance without knowing the state of health the borrower was in, and charging him an option premium which was perhaps inadequate, and would certainly not be supported by a sufficient number of transactions to form an average.

Mr. D. A. BUMSTED said that practically the whole paper dealt with powers of redemption, the object apparently being to whittle down the profits of the lender or of the insurance office that granted the policy; but if that was done on a large scale the lenders would have no money to lend, and the insurance offices would be in very much the same position. He agreed with Mr. Chisholm that Dr. Sprague's plan seemed to be the most satisfactory. His experience was that the limited period of redemption within five years was injurious to the office; it lost the chance of a large profit in those years. Dr. Sprague's plan was to treat the security for the first five years as a loan and not as a reversionary charge at all. When it was a loan it bore interest for the five years, and at the end of the five years it was converted into a reversionary sum. That seemed to be perfectly logical, and, on the whole, it was not unsatisfactory to the office. Referring to the table on absolute reversions, he said that, roughly speaking, the ultimate charge was the loan with 5 per-cent compound interest accumulated during the expectation of the life. So that during the time that they might expect the security to last a fixed sum of 5 per-cent interest was obtained and no profit at all was to be gained for early mortality. When the reversionary charge payable on the death of those who survived their expectations came into operation, they were all very hardy lives and would probably live to 95 and no profit would be obtained on them, so that it seemed to him that the profit on transactions of that sort was very little compared with what it ought to be. A few such cases and a number of other cases would altogether upset the average, as Mr. Faulks had mentioned.

On the motion of the President, a vote of thanks was unanimously accorded to Mr. Paterson for his paper.

Mr. PATERSON, in reply, thanked the members for the vote. He was afraid that his long formulas were not very intelligible without more time to study than was possible for anyone to give at a first reading, and it might be that in that way some of the points were lost. They were all in reality very simple and straightforward, and no one could have any difficulty after looking them over at his leisure

in understanding them thoroughly. The President had made a reference to his previous paper, and had accused him of proposing that net premiums should be charged. Throughout that paper he made it plain that he had no intention of charging net premiums. The sole departure from the ordinary methods in that paper was in respect of the date of payment of premiums, not the loading. It appeared to him at that time, and it appeared to him still, that when an office had absolute security that premiums would be paid if certain events arose then it was quite justified in charging premiums payable in those events in place of the ordinary annual premium from the outset. That was the only departure in his previous paper from accepted principles, and that departure produced results which, with Jellicoe's formula, were extremely favourable to the reversioners as compared with the ordinary methods, but in the last seven years such a change had come over the valuation of reversions that the advantage of the methods spoken of in his paper had to a large extent disappeared. If the managers of offices insisted upon paying 4 per-cent net values for reversions, the difference in formula was quite beside the mark. If it was a 4 per-cent net value it was a 4 per-cent value, and no alteration made in the method of charging premiums would make very much difference in the result. He thought the President would remember that that was one of the points that he (Mr. Paterson) was very anxious to bring out clearly in his paper, that neither in the loading of the premium nor in the matter of the rate of interest had he any desire to encroach on the profit of the office. His point was that by charging the premium at the date when the money was payable a smaller amount of insurance was involved in the transaction. He did not think it was a right view for offices to take, that a transaction should be loaded as heavily as it possibly could be with insurances. He thought that was a mistake. Rather too greedy a view might be adopted if too large margins in insurance were kept, or by increasing unnecessarily the amount of insurance involved in any transaction. With regard to the present paper, a remark had been made by the President as to the Carlisle Table with  $3\frac{1}{2}$  per-cent interest and 10 per-cent loading being unsuitable for both male and female lives. He quite agreed with him that it was not suitable for female lives, and when a transaction came before him he always made a distinction between one and the other. It was a simple matter to take an equivalent. He thought there was no better method with present tables when one was calculating rather a complicated problem and was limited in the number of tables which could be employed, than to make some rough approximation of the kind, taking an equivalent age. As to the premiums on the life of the reversioner after the death of the life-tenant, those premiums were not fixed at the outset, because it was impossible to fix when the life-tenant was going to die, and the premium was charged at the reversioner's then age, whatever it might be, not exceeding a maximum premium which had been already fixed, because otherwise the annual charges would run up to too large a figure. In the same connection he might deal with one of Mr. Tilt's remarks, that the redemption prices or capital reversionary charges, after the annual reversionary charges had been entered upon, would



decrease. They should not decrease, because a life interest in possession after the premium had once been set up to cover it always remained of the same value to the end of life—it never decreased in value. While the life interest—the remainder of the annuity—was decreasing in value, the policy was increasing in value. There seemed to be an impression in the minds of those who had criticized the paper that he had some intention of forcing reversioners to take those increasing charges in preference to the system of loans running up. Of course it was impossible to force any reversioner to take up a scheme suggested by the office if it did not suit him, and he simply put forward the increasing reversionary charges as another method of dealing with those matters than those at present in use. He thought he might say, without doing anything that was contrary to the ordinary practice of the Institute, that in his own office it had been found that there was no great scarcity of men in the position that he mentioned, M.P.'s and others, who had large expectations, and whose position quite justified them in increasing their present income. The method usually adopted had been that, instead of lending a cash sum, an annuity during the joint lives had been taken, putting the whole matter on a permanent footing, and giving the reversioner a permanent income during the whole life of the present tenant for life; he might have an annuity of £1,000 a year, his expectations being very much larger. He would never recommend the use of those formulas in any case where there was not a very large margin over and above the maximum reversionary charge. As to the profit, he had dealt with that to some extent by saying that in the case of a female life-tenant he certainly would recommend exceptional treatment, but the other point was a general one, namely, whether the profit to be derived from the class of policy which he proposed to include in those schemes was equal to the profit to be derived from the whole-life policies. That was all a matter of the premium charged, and did not alter the principle of the increasing reversionary charges. He had not submitted the paper with the idea of showing that the increasing reversionary charges were cheaper, taking them all round, for the reversioner than a level charge; his point was that the system had certain features different from the level charge, and in many cases the reversioners might be attracted by them: they might be more suitable to the circumstances of the case. He would be the last to recommend any curtailment of the profit in rates for insurances that might have to be set up in connection with those transactions, or any reduction in the rate of interest below a reasonable rate. He was extremely sorry to see the course that had been followed in the last four or five years in the matter of purchase of reversions. It had reached a point at which an ordinary purchase in the open market on the ordinary lines was almost impracticable, if one was to keep in mind the interests of his office.

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*The Methods of Analyzing and Presenting the Mortality, Sickness, and Secession Experience of Friendly Societies, with Examples drawn from the Experience of the Manchester Unity of Odd-fellows.* By ALFRED W. WATSON, F.I.A.

[Read before the Institute, 26 March 1900.]

THE publication of the Sickness and Mortality Experience of Registered Friendly Societies, the work of our late distinguished member, Mr. W. Sutton, has directed the serious attention of the Manchester Unity of Oddfellows to the question of the continued reliability of the Tables on which the Society has been accustomed to base its financial estimates, and as the result of the interest thus awakened, the Actuaries of the Order have been instructed to make a complete investigation of its experience during the five years 1893-97. From the immensity of the data to be handled in this investigation (these being contributed by about 3,500 branches and comprising, *inter alia*, some three million years of life and 40,000 deaths) it has been necessary, at the outset, to closely consider the methods of tabulation and classification to be adopted, and preliminary experiments on a somewhat elaborate scale have accordingly been required. The results of these experiments appear to possess a definite value in relation to the subject of friendly society experience, and I am emboldened on this account to offer the following notes respecting them for the consideration of this meeting.

#### RELIABILITY OF DATA.

On the subject of the reliability of the data which have been employed, I may explain that the experience of the Branches has been furnished on cards, thus avoiding the labour of copying from sheet returns with its consequent risk of error; that dates of birth have been supplied in a large number of cases (probably the majority), and that where dates of birth could not be given, ages (last birthday) at admission have been accepted. The substantial accuracy of these may be admitted, since they are embodied in formal declarations made at admission, and are nearly always corroborated by the ages given on the certificates of death. Experience ages have throughout been assumed to coincide with calendar years; the nearest age on each 1 January has been taken in cases where dates of birth were given, and in

other cases the stated age at admission has been assumed to have been attained on the preceding 1 January. The numbers of cards supplied (in distinctive colours) for the three classes of members—died or withdrawn during the period of observation, or existing on 31 December 1897—have been verified throughout by the returns which are annually made to the Central Office, and the entries of sickness claims have been compared in the mass with abstracts of the Lodge accounts, and all differences, except the most trifling, investigated in detail. Having regard to the circumstance that the basis facts have been compiled with an appreciative willingness by a competent body of secretaries, that the work of these has in its turn been examined by district secretaries, themselves, as a rule, officials of Lodges, and therefore possessing all necessary practical knowledge, and subsequently scrutinized by a carefully chosen audit staff, and bearing in mind (and this is not the least important point) the comparative uniformity of rules and practice by which the branches are administered, I think I am entitled to claim that the actuarial deductions rest upon a foundation of unimpeachable stability.

#### PREVIOUS INVESTIGATIONS.

The first point that arose in the investigation was that of the distribution of the data with reference to the important questions of locality, density of population, and occupation. An examination of existing standards afforded but little guidance, and it early became evident that if the new standard was to be thoroughly serviceable, in every part, its classifications would have to be made to a large extent on original lines. The following Table shows concisely the divisions that have hitherto been made, and which, in considering the subject anew, it is convenient to recapitulate even at the risk of going over familiar ground:—

TABLE 1.

Investigation	Principal Classifications made	Special Classes
Neison's Registered Friendly Societies Experience, England and Wales, 1836-40	Rural, Population? Town, Do. City, Do.	Various Trades and Localities taken out separately, but stated as examples only. Monetary tables not being deduced.
A. G. Finlaison's Registered Friendly Societies Experience, England and Wales, 1846-50	1. (a) By Locality. England and Wales being divided into 8 Provinces. (b) Sub-classification by Trades. (a) Light Labour, with Exposure to Weather. (β) " " without " " " (γ) Heavy Labour, with " " " (δ) " " without " " " 2. (a) By Density of Population. (a) Rural, Places with under 3,000 population; also all not included in (β) and (γ). (β) Town, Places with population between 3,000 and 65,000. (γ) City, Places with population exceeding 65,000, and averaging not less than 6½ persons per house. (b) Sub-classification by Trades as 1 (b) above.	Special Classes, constituted of Mariners, Painters, Policemen, Females, Railway Servants, Miners and Colliers, South-Western Metal Miners.  NOTE.—Of these, Colliers, Miners, Mariners, and Females, are not included in the general Tables. Inferentially the other classes are so included.
Ratcliffe's Manchester Unity of Odd-fellows Experience, 1848-50	Rural, Places with under 5,000 population. Town, Places with population between 5,000 and 30,000. City, Places with population over 30,000.	Experience of Various Trades and Localities exhibited separately, but monetary tables not deduced.
The same Society, Experience, 1856-60	Rural, Town, and City, as above.	Miners and Colliers.
The same Society, Experience, 1866-70	Rural, Town, and City, as above.	Miners and Colliers.
Neison's Ancient Order of Foresters Experience, 1871-75	Rural, Town, and City. Definitions as Manchester Unity?	None.
Sutton's Registered Friendly Societies Experience, England and Wales, 1876-80	Five Groups determined by Population, viz.: Under 2,000. 2,000-7,000. 7,000-25,000. 25,000-100,000. Over 100,000.  NOTE.—The facts are scheduled separately for each age at admission, but in this form are not reduced to rates or otherwise actuarially dealt with.	None.
Sutton's Registered Friendly Societies Experience, Wales only, 1856-75	None.	Stated to practically represent the effects of hazardous occupations, being composed largely of experience of Colliers and Iron-workers.

Neison was apparently the originator of the threefold division into rural, town, and city districts, and his influence on subsequent workers is clearly traceable through this Table. There is something to be said, perhaps, for a method of apportionment which so aptly responds to the popular conception of the relative value of life in town and country, and that the method of division by populations is not entirely barren of result, so far as concerns mortality, is shown by the following Table of the expectations of life in—

- (1.) Rural, town, and city districts of the Manchester Unity, and
- (2.) The several population groups of Mr. Sutton's tabulation of the 1876-80 Experience. These latter are deduced from the unadjusted data, which I have compiled from Mr. Sutton's published work, excluding the first three calendar years of assurance.

TABLE 2.

*Expectations of Life by Various Standards.*

Age	MANCHESTER UNITY, 1866-70				REGISTERED FRIENDLY SOCIETIES, 1876-80					
	Rural Population under 5,000	Town Population 5,000 - 30,000	City Population upwards of 30,000	Rural, Town, and City combined	Group 1, Population under 2,000	Group 2, Population 2,000 - 7,000	Group 3, Population 7,000 - 25,000	Group 4, Population 25,000 - 100,000	Group 5, Population upwards of 100,000	All Groups combined
	$\bar{e}_x$	$\bar{e}_x$	$\bar{e}_x$	$\bar{e}_x$	$\bar{e}_x$	$\bar{e}_x$	$\bar{e}_x$	$\bar{e}_x$	$\bar{e}_x$	$\bar{e}_x$
20	43·0	41·4	40·1	41·4	43·3	42·2	42·1	39·8	39·7	41·3
30	35·5	34·1	32·8	34·0	35·7	34·5	33·9	32·4	31·8	33·6
40	28·3	26·8	25·8	26·8	28·0	27·0	26·4	25·3	24·7	26·2
50	21·2	19·9	19·0	19·9	20·5	19·7	19·3	18·5	18·2	19·2
60	14·8	13·4	13·2	13·6	13·9	13·4	12·9	12·6	12·1	12·9
70	9·2	8·3	8·3	8·5	8·9	8·5	7·9	7·7	7·3	7·9

In Table 3 the "Expected" deaths in each of Sutton's population groups, computed by multiplying the numbers at risk at each age by Ratcliffe's  $q_x$  (rural, town, and city combined), are shown in comparison with the actual deaths, the ratio of actual to expected being added.

TABLE 3.

Sutton's "Males 1876-80" Mortality Experience.—Comparison of Actual Deaths with "Expected", derived from Manchester Unity Experience, 1866-70 (Rural, Town, and City Districts combined).

Ages	GROUP 1				GROUP 2				GROUP 3				GROUP 4				GROUP 5			
	Exposed to Risk	Expected Deaths	Actual Deaths	Percentage Actual to Expected	Exposed to Risk	Expected Deaths	Actual Deaths	Percentage Actual to Expected	Exposed to Risk	Expected Deaths	Actual Deaths	Percentage Actual to Expected	Exposed to Risk	Expected Deaths	Actual Deaths	Percentage Actual to Expected	Exposed to Risk	Expected Deaths	Actual Deaths	Percentage Actual to Expected
16-24	48238.5	316	309	98	43615.5	309	249	81	28037	184	134	73	28211	186	187	100	15586	102	71	70
25-34	127528	1,008	791	78	130750	1,036	858	83	101001.5	802	683	85	113375.5	941	906	96	79289	633	650	103
35-44	93041.5	1,018	781	77	1,116,104.3	937	826	88	85968	940	864	92	109419	1,202	1,288	107	81997	900	1,024	114
45-54	53938.5	890	719	81	56860	937	826	88	47853.5	789	774	98	63086.5	1,038	1,179	114	48364	796	966	121
55-64	27160.5	818	780	95	28106	848	867	102	23082	695	717	103	30225.5	907	1,087	120	21725.5	652	763	117
65-74	10916	661	645	98	11164.5	670	710	106	9306.5	558	618	111	11162	664	728	110	7882	472	577	122
75-84	2306	278	265	95	2155	260	261	100	1408	166	186	112	1842	220	262	119	1068	124	161	130
over 84	104	23	16	70	92	20	20	100	42	11	9	82	96	22	28	127	35	7	10	143
	363233	5,012,430.6	—	...	374834	5,196,483.4	—	...	296698.5	4,145,398.5	—	...	362417.5	5,180,566.5	—	...	255946.5	3,686,422.2	—	...

Abstract of the foregoing									
-44	268808	2,342,188.1	80	276456.5	2,461,215.0	87	215006.5	1,926,168.1	87
45-64	81099	1,708,149.9	88	84966	1,785,169.3	95	70935.5	1,484,149.1	100
over 64	13326	962,926	96	13411.5	950,991	104	10756.5	735,813	111
	363233	5,012,430.6	...	374834	5,196,483.4	...	296698.5	4,145,398.5	...
							362417.5	5,180,566.5	...
							255946.5	3,686,422.2	...



Had the object of these classifications been only to establish the proposition that density of population is a factor in the duration of life, it might, on the showing of Tables 2 and 3, be fairly held that they had achieved their purpose. But no such definite result is found when the same method of apportionment is applied to the sickness experience, the variations in which it was equally important to measure. In Table 4 an extract from Mr. Neison's Report on the Experience of the Ancient Order of Foresters is given, showing the comparative quantity of sickness in each of the three divisions, and in Table 5 a like comparison of the Manchester Unity sickness (1866-70). It will be seen that in the Foresters' Experience the "rural" claims were, throughout the whole scale of ages, below the average of the combined districts, the town experience in close agreement with the general average up to 60 years of age, and afterwards in considerable excess, and the "city" experience in excess up to 60, afterwards falling into the general average. Like irregularities mark the Manchester Unity Experience, but, as though to prove the futility of this method of apportionment, the differences run in the opposite direction to those of the Foresters' tables. The "rural" experience is, for example, quite up to the general average up to 70 years of age, the "town" experience falling below the average at the older ages, and the "city", only, rising above it.

TABLE 4.

*Ancient Order of Foresters, 1871-75.—Ratio of Sectional Sickness Experience to that of the whole Society.*

Ages	Rural	Town	City	Rural, Town, and City combined
20-30	·98	1·02	1·01	1·00
30-40	·93	1·00	1·06	1·00
40-50	·86	1·01	1·10	1·00
50-60	·82	1·01	1·14	1·00
60-70	·89	1·11	1·02	1·00
70-80	·95	1·07	·98	1·00

TABLE 5.

*Manchester Unity, 1866-70.—Ratio of Sectional Sickness Experience to that of the whole Society.*

Ages	Rural	Town	City	Rural, Town, and City combined
20-30	1·01	1·02	·97	1·00
30-40	1·00	1·01	1·00	1·00
40-50	1·00	1·01	1·00	1·00
50-60	1·02	·97	1·03	1·00
60-70	1·00	·94	1·10	1·00
70-80	·90	·97	1·12	1·00

It is difficult to realize what was the result expected from this method of division. It would seem to have been considered either that sickness varied inappreciably under different conditions, and that all that was necessary was to measure the effect of certain influences on the duration of life, or that sickness varied directly or inversely with mortality, and that an apportionment which gave the rates of mortality prevailing in certain defined areas would, at the same time, give the sickness common to such areas without further sub-division of the data. It may perhaps be inferred that the second hypothesis was the one acted upon. In the new Investigation, which has furnished the subject of this paper, it was deemed necessary to give wholly separate consideration to the elements of sickness and mortality, and, whilst dealing with the latter to some extent on the basis of density of population, to analyze the sickness of each division in broad groups of occupations. I do not claim the merit of novelty for this method of approaching the subject, which, indeed, would appear to have been at the foundation of some of the divisions made by the late A. G. Finlaison (Friendly Societies Experience, 1846-50). I doubt whether Finlaison's Report on this Experience receives much attention from students at the present day, but, in some respects it appears to me to afford an admirable model. I do not, of course, desire to revive forgotten controversies by discussing the distinction raised between sickness and superannuation; on that point I have been constrained, though not altogether willingly, to follow later investigators, and accept the recorded claims in their entirety as representing sickness within the meaning of the friendly society contract.



# ENGLAND AND WALES.

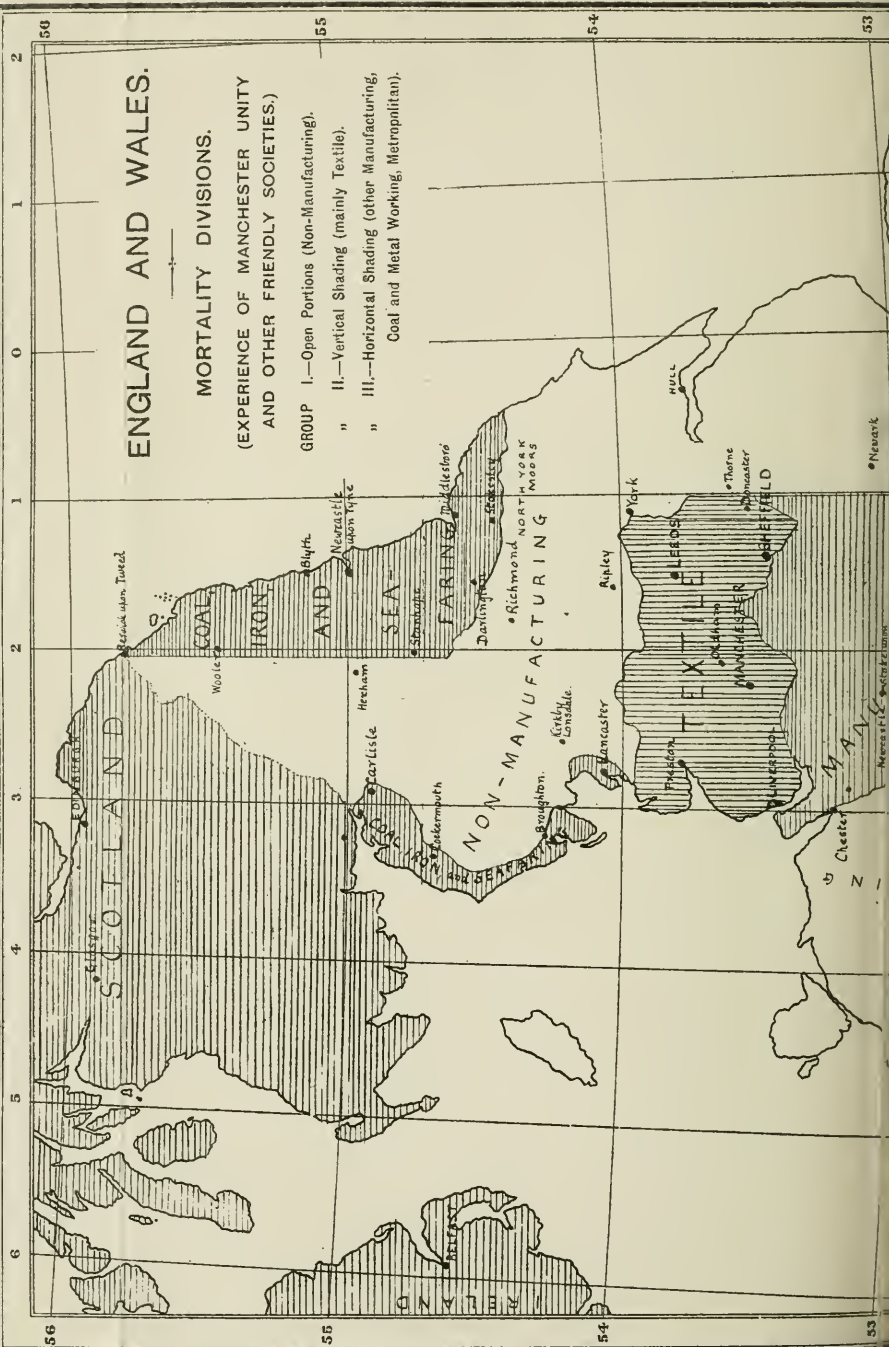
## MORTALITY DIVISIONS.

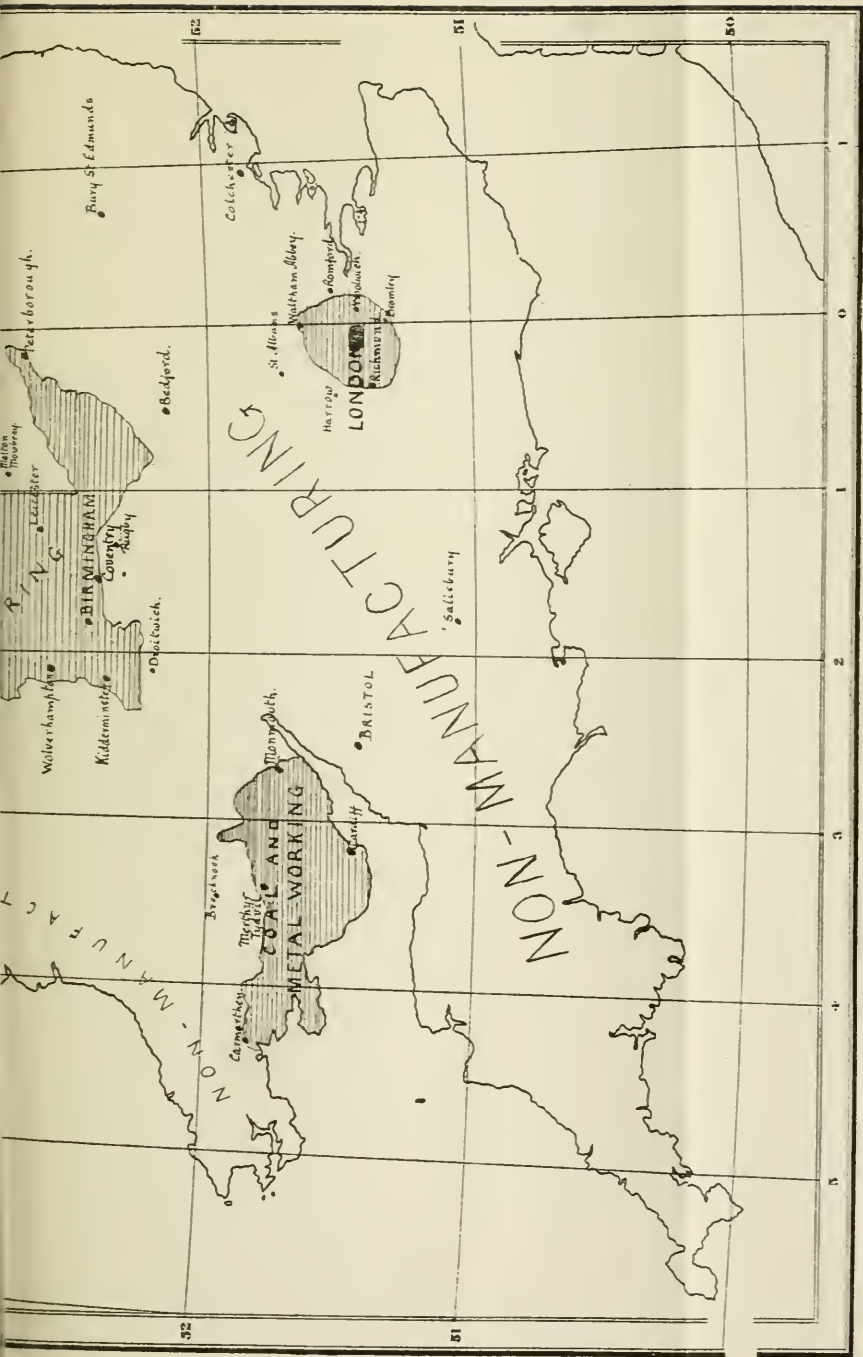
(EXPERIENCE OF MANCHESTER UNITY  
AND OTHER FRIENDLY SOCIETIES.)

GROUP I.—Open Portions (Non-Manufacturing).

" II.—Vertical Shading (mainly Textile).

" III.—Horizontal Shading (other Manufacturing,  
Coal and Metal Working, Metropolitan).









## MORTALITY.

Having regard to the regularity of progression in Mr. Sutton's mortality rates, when compared group by group, it needs, perhaps, a more than common amount of scepticism to suggest that a final and adequate distribution of the data with respect to this important element has not yet been attained. I have, nevertheless, been unable to contentedly accept the population method, to satisfy myself against experience that data drawn from such dissimilar centres as, say, Bath and St. Helen's, Norwich and Preston—alike only in population—may be aggregated to find a measure of life that shall be common to both of them, or, for the same illusory purpose, to throw into hotchpot the village life of rural Suffolk and that which clusters round the pit mouth or the tin plate foundry in the numerous small communities of South Wales. The figures of Table 3, indeed, go far to confirm my doubts. I find it impossible to believe, on the one hand, that the remarkable longevity of friendly society life in (for example) the Eastern counties should be represented by a bare 5 per-cent in the death rates (*vide* ages 55–84, Group 1) as compared with the Manchester Unity Table, and, on the other hand, that the mortality of the textile districts of Lancashire and Yorkshire, which in all classes of friendly society has generally been found extremely heavy, should be represented by an extra 30 per-cent on the mortality of the healthiest localities, which, however, is practically all the difference between the death rates of Mr. Sutton's extreme Groups 1 and 5. Seeing that no apportionment by population could avoid the confusion of heterogeneous data, it was decided, in the first place, to deal with the experience in three broad groups, which, for want of a better description, may be termed the Non-manufacturing (Group I), the Textile, comprising Lancashire and the West Riding of Yorkshire and part of Cheshire (Group II), and the Manufacturing—Textile excluded—(Group III), in which last were included contiguous portions of the counties of Leicestershire, Nottinghamshire, Derbyshire, Northamptonshire, Warwickshire, and Staffordshire, the Metropolis, South Wales (including Monmouthshire), the Eastern portions of the counties of Northumberland and Durham, and the mining districts of the North West Coast. (See appended map, in which the area of Group II is shown by vertical shading, and that of Group III by horizontal shading, the area of Group I being left open.) The limited

experience obtained from Ireland and Scotland was included in Group III. As a test of this apportionment, the experience of 100 lodges (taken promiscuously) in each division was brought together, and the "expected" deaths in each group computed on the Manchester Unity Table, 1866-70 (rural, town, and city combined). The results thus obtained, which prove to be very much as anticipated, are shown in Table 6 (p. 277).\*

In the abstract of Table 6 the differences between the three sets of experience are more clearly visible, and they are distinctly shown in the several expectations of life as deduced from the unadjusted values of  $l_x$  for each group (Table 7) (p. 278).

It is difficult to compare the expectations of life throughout the scale with those of Table 2, owing to the low mortality prevailing at the early ages in all the three groups. This feature, which is in itself significant, is, however, exhausted at about 50 years of age, and from that age upwards, comparisons being undisturbed by any exceptional cause, it is found that the expectations of life in Group I are closely approximate to the Manchester Unity Rural (1866-70), and above those of Sutton's Group 1 (population under 2,000), while those of Group II are distinctly below those of the Manchester Unity City (1866-70) and tend to fall below Sutton's Group 5 (population over 100,000). Group III occupies an intermediate position corresponding most nearly to Manchester Unity Town (1866-70) and Sutton's Group 2 (population 2,000-7,000).

Considering the wide range of the data which entered into each of the experimental groups, it appeared probable that further divisions might be profitably made, and the data were re-classified to show, respectively, the Rural and Urban experience in each group. In this further discrimination the population-test was still avoided, and a Rural Lodge was defined as one having amongst its members a purely agricultural element, *e.g.*, farmers, farm-labourers, husbandmen, and the like. It may be that on

\* In these comparisons I have somewhat freely used the term "expected deaths" as implying the product of the numbers exposed to risk multiplied by the tabular  $q_x$ . This term is, however, scarcely accurate, the true "expected deaths" at any age being obviously a function of the "expected number at risk", *i.e.*, the expected number of survivors to the age computed on the assumption that at the earlier ages within the observations the tabular mortality had prevailed. The point has been touched upon by Mr. R. P. Hardy (*J.L.A.* xxxi, 253), who appears, from his remarks, to condemn the common usage in this respect. The fault would seem, however, to lie in the description "expected deaths" rather than in the method of calculating the quantity so designated—at any rate when the purpose to be served is the comparison of two experiences at individual ages.

TABLE 6.  
*Comparison of Actual and Expected Mortality, Three Groups of Lodges of the Manchester Unity (1893-97).*

Ages	Group I					Group II				Group III			
	Exposed to Risk	Expected Deaths		Actual Deaths	Ratio, Actual to Expected on (a)	Exposed to Risk	Expected Deaths, Manchester Unity, Rural, Town and City	Actual Deaths	Ratio, Actual to Expected	Exposed to Risk	Expected Deaths, Manchester Unity, Rural, Town and City	Actual Deaths	Ratio, Actual to Expected
		Manchester Unity, Rural, Town and City	Manchester Unity, Rural										
		(a)	(b)										
16-24	19967.5	126	116	57	.45	12980	85	60	.71	16406.5	104	48	.46
25-34	28858.5	228	224	153	.67	22511.5	178	122	.69	26919.5	213	123	.58
35-44	21864	239	223	158	.66	16898	185	153	.83	19240	211	165	.78
45-54	16175	272	224	200	.73	11955.5	200	198	.99	13022	217	188	.87
55-64	10191	307	272	234	.76	7519	231	227	.98	7218	216	229	1.06
65-74	4087	257	214	233	.91	2915.5	180	242	1.34	2742.5	170	163	.96
75-84	1335.5	155	149	143	.92	1016.5	128	166	1.30	811	100	112	1.12
over 84	115	25	24	25	1.00	62	13	16	1.23	58	13	13	1.00
	102593.5	1,609	1,446	1,203	...	75858	1,200	1,184	...	86417.5	1,244	1,041	...
Abstract of the foregoing													
-44	70690	593	563	368	.62	52389.5	448	335	.75	62566	528	336	.64
45-64	26366	579	496	434	.75	19474.5	431	425	.99	20240	433	417	.96
over 64	5537.5	437	387	401	.92	3994	321	424	1.32	3611.5	283	288	1.02
	102593.5	1,609	1,446	1,203	...	75858	1,200	1,184	...	86417.5	1,244	1,041	...

TABLE 7.

*Three Groups of Lodges, Manchester Unity Experience, 1893-97.—Complete Expectations of Life.*

Age	Group I $\mathcal{E}_x$	Group II $\mathcal{E}_x$	Group III $\mathcal{E}_x$
20	45.57	42.00	43.88
30	37.34	33.84	35.35
40	29.39	25.74	27.37
50	21.62	18.57	20.04
60	14.64	11.82	13.58
70	9.06	6.92	7.98
80	5.25	3.75	4.24

such a rule a small amount of experience which might be classed as rural has found its way into the urban group, but some arbitrary rule is necessary and the error is probably less than would result from the adoption of any other plan.

The results of this apportionment are shown in Table 8, and in compressed form in Table 9.

TABLE 8.

*Comparison of Actual and Expected Deaths in the Three Selected Groups of the Manchester Unity, each Group being divided into Rural and Urban Sections ("Expected" by Rural, Town, and City Districts combined, 1866-70).*

Ages	GROUP I				GROUP II				GROUP III			
	Rural		Urban		Rural		Urban		Rural		Urban	
	Expected Deaths	Actual Deaths	Expected Deaths	Actual Deaths	Expected Deaths	Actual Deaths	Expected Deaths	Actual Deaths	Expected Deaths	Actual Deaths	Expected Deaths	Actual Deaths
16-24	102	45	24	12	24	20	61	40	38	17	66	31
25-34	182	111	46	42	52	29	126	93	68	32	145	91
35-44	186	114	53	44	59	41	126	112	70	43	141	122
45-54	216	164	56	36	64	50	136	148	79	56	138	132
55-64	246	179	61	55	72	57	159	170	92	88	124	141
65-74	226	191	31	42	58	83	122	159	71	63	99	100
75-84	143	133	12	10	34	43	94	123	48	51	52	61
over 84	24	24	1	1	5	8	8	8	7	9	6	4
	1,325	961	284	242	368	331	832	853	473	359	771	682



TABLE 9.  
Summary of Table 8.

Ages	Group I						Group II						Group III					
	Rural			Urban			Rural			Urban			Rural			Urban		
	Expected Deaths	Actual Deaths	Percentage of Actual to Expected Deaths	Expected Deaths	Actual Deaths	Percentage of Actual to Expected Deaths	Expected Deaths	Actual Deaths	Percentage of Actual to Expected Deaths	Expected Deaths	Actual Deaths	Percentage of Actual to Expected Deaths	Expected Deaths	Actual Deaths	Percentage of Actual to Expected Deaths	Expected Deaths	Actual Deaths	Percentage of Actual to Expected Deaths
-44	470	270	57	123	98	80	135	90	67	313	245	78	176	92	52	352	244	69
45-64	462	343	74	117	91	78	136	107	79	295	318	108	171	144	84	262	273	104
over 64	393	348	89	44	53	120	97	134	138	224	290	130	126	123	98	157	165	105
Re-Grouping																		
under 55	686	434	63	179	134	75	199	140	70	449	393	88	255	148	58	490	376	77
over 55	639	527	82	105	108	103	169	191	113	383	460	120	218	211	97	281	306	109

These results, if I may claim so much, appear to have in them the elements of finality. With one unforeseen exception, which may disappear when a larger number of facts is employed, namely, the excess of Rural over Urban mortality at the later ages in Group II, the Rural mortality in each group is below that of the Urban class, whilst the respective differences between the three groups, when each is taken as a whole, are, for the most part, apparent in their sub-divisions. It is interesting to compare the expectations of life of the two extreme classes—the Rural of Group I and the Urban of Group II, and these are given in Table 10.

To this Table I have added three columns giving the differences between the expectations of life in the extreme classes of three investigations, namely, the new Manchester Unity (experimental); the Manchester Unity 1866-70,—the extremes of which are “Rural” (population under 5,000) and “City” (population over 30,000); and Sutton’s 1876-80, the extremes of which are Group 1 (population under 2,000) and Group 5 (population over 100,000). In the result a greater difference throughout is found between the “expectations” of my Group I Rural and Group II Urban than between those of either of the standards with which comparison is made and in which division by population alone was employed.

TABLE 10.

*Comparison of Expectations of Life, in Extreme Groups.*

Age	Rural Class of Group I	Urban Class of Group II	Difference	Difference between Expectations, Manchester Unity, Rural and City	Difference between Sutton's Expectations, Groups 1 and 5
	$e_x$	$e_x$			
20	46.3	41.3	5.0	2.9	3.6
30	37.8	33.3	4.5	2.7	3.9
40	29.8	25.2	4.6	2.5	3.3
50	22.0	18.2	3.8	2.2	2.3
60	15.0	11.7	3.3	1.6	1.8
70	9.3	7.1	2.2	.9	1.6

As a possible explanation of the differences between the “Rural” experiences in my three groups (Table 9) I would

suggest that the rural lodges in Groups II and III being for the most part in close contiguity to the large industrial centres their membership is affected to a greater extent by migration to the towns than is that of the more remote branches which generally comprise Group I. It is within my experience that in the great towns there is a large element of "country members", who, although permanently removed from their early homes, retain their original membership through the agency system which the Order has developed, and these members would of necessity be included in the rural groups in any distribution of mortality data.

The following Tables were prepared from the recent experience of certain "County" and other Societies in order to obtain an independent test of the suitability of the data drawn from the "rural" lodges of Group I as an exponent of the duration of life in rural localities. It is perhaps necessary to say that these Societies have not been "selected" for comparison, except in the sense that they were known to obtain their membership from districts in which the agricultural class predominated.

Table 11 gives the experience over series of years of the Hampshire Friendly Society, Stoke and Melford Union Association, and Essex Provident Society; these being almost entirely rural.

Table 12 combines the experience of the Rational Association (a large Society, which, though having its Chief Office in Manchester, draws a great part of its membership from the country districts), and that of a large district of the Manchester Unity, with about two-thirds of its members resident in East Anglian villages; this experience may be described as semi-rural.

TABLE 11.  
*Mortality Experience of County Societies.*

Ages	HAMPSHIRE FRIENDLY SOCIETY (1874-94)				ESSEX PROVIDENT SOCIETY (1876-80, 1886-93)				STOKE AND MELFORD UNION ASSOCIATION (1876-84, 1890-94)			
	Exposed to Risk	Expected Deaths, Manchester Unity (Rural, Town and City)	Actual Deaths	Ratio of Actual to Expected Deaths	Exposed to Risk	Expected Deaths, Manchester Unity (Rural, Town and City)	Actual Deaths	Ratio of Actual to Expected Deaths	Exposed to Risk	Expected Deaths, Manchester Unity (Rural, Town and City)	Actual Deaths	Ratio of Actual to Expected Deaths
Under 25	45324.5	269	116	.34	1030	7	6	.86	7847	48	32	.66
25-44	42797.5	387	252	.65	11211.5	115	96	.83	9408	86	63	.73
45-64	14054.5	293	206	.70	27990	712	535	.75	7864	182	108	.59
65-84	1453	102	74	.72	14911	1,224	1,086	.89	*1153.5	84	79	.94
85 & over	15	3	3	1.00	264.5	68	69	1.01	...	...	...	...
	103644.5	1,054	651	.62	55407	2,126	1,792	.84	26272.5	400	282	.70

\* The experience from age 65 is that of the five years, 1890-94 only.

TABLE 12.

*Mortality Experience of Rational Association (1894-98), and certain Eastern Counties, Manchester Unity.*

Ages	Exposed to Risk	Expected Deaths Manchester Unity (Rural, Town, and City)	Actual Deaths	Ratio of Actual to Expected Deaths
Under 25	97261·5	643	400	·62
25-44	229938	2,109	1,300	·62
45-64	64696	1,359	1,009	·74
65-84	7600·5	548	511	·93
85 and over	42·5	3	4	1·33
All Ages	399538·5	4,662	3,224	·69

The following Summary of Tables 8, 11, and 12, appears to afford all necessary confirmation of the method employed to obtain a reliable measure of friendly society life in the essentially rural districts.

TABLE 13.

*Summary of Tables 8, 11, and 12.—Rural Life.*

Ages	RATIO OF ACTUAL TO "EXPECTED" DEATHS		
	Three County Societies	Rational Association, and East Anglian Manchester Unity	Manchester Unity, "Rural" of Group I 1893-97
	Table 11	Table 12	Table 8
Under 45 . . .	·62	·62	·57
45 and under 65	·72	·74	·74
Over 65 . . .	·89	·93	·89

The suitability of the grouping employed to obtain an experience applicable to the Metropolis and to other industrial centres outside of the textile area (which experience I have temporarily designated Group III, Urban) has been tested by comparison with the experience of a portion of one of the London districts of the Manchester Unity, which was analyzed for an independent purpose, and an abstract of which is contained in Table 14. This experience, covering the nine years 1887-95, embraced over 63,000 years of life, and, as will be seen, the relation of actual to expected deaths was similar, on the whole, to that of Group III, Urban, as shown in Tables 8 and 9.

[It should be mentioned of this experience that it was exceptional in showing a slowly increasing rate of lapse at the



older ages, this being due to the constitution of the fund which offered no inducement to aged widowers to retain their membership. Whether the widowers withdrawing at the older ages were better or worse lives than the average there is nothing to show, but there are no reasons for supposing that either was the case].

TABLE 14.

*Mortality Experience of Widows' and Orphans' Fund,  
South London District, Manchester Unity, 1887-95.*

Ages	Exposed to Risk	Expected Deaths (Manchester Unity, 1866-70)	Actual Deaths	Proportion of Actual Deaths to Expected	The like proportion in Group III, Urban (from Table 9)
16-24	8270.5	51	17	} .74	.69
25-34	22022	171	114		
35-44	14660	157	150		
45-54	9565.5	154	168	} 1.02	1.04
55-64	4902	145	138		
65-74	2773.5	168	198	} 1.14	1.05
75-84	874	105	118		
over 84	24	6	3		
All ages	63091.5	957	906	...	...

## SICKNESS.

In distributing the sickness experience according to the various classes of risk, a new set of considerations presented themselves, and although it was decided, as a matter of convenience, to collect up the facts in the three groups, with their sub-divisions of rural and urban localities, which were to give the mortality experience, it was not expected that any useful result would follow from this classification of sickness.\* The essential elements in this liability would appear to be occupation and efficiency of supervision over the claims; but although some presumptive evidence as to the latter was available, as hereafter explained, it was obvious that it could not be made a factor in any general analysis of sickness liabilities. The only practical point on which the experience could be differentiated was, therefore, that of occupation, and on this element the experimental work was ultimately concentrated.

The formulation of a principle on which to proceed was found a sufficiently difficult task; on the one hand it was felt that an

\* The likelihood of a certain amount of difference between the aggregate rates of the three locality groups did subsequently appear, but this was due to a wholly independent cause (see pp. 295, 6).

exhaustive discrimination not only demanded a phenomenal knowledge of industrial conditions, but was opposed to the principle of "broad trading", to which the practice of the majority of friendly societies must and does conform, whilst on the other hand it was known that certain occupations tended to group themselves in particular districts, and so to concentrate the risks which, if diffused, might safely have been ignored. Having in view this tendency, it was resolved to group, on the broadest possible lines, the classes to which exceptional liabilities were believed to be attached, but to omit from special treatment those minor classes (such, for example, as policemen), which, whilst involving undoubted extra risk, were seldom found in sufficient numbers to exert a material influence on the general mass. Before arriving at this conclusion, three precedents had to be examined:—

- (1.) The searching classification of A. G. Finlaison, which grouped every trade, with certain exceptions, under one of four headings, according to the degree of manual exertion which it demanded, and the conditions, as to exposure to weather, under which it was exercised; the experience of some special classes being also separately analyzed.
- (2.) Ratcliffe's separate examination of the experience of one class—miners and colliers.
- (3.) Sutton's Welsh Experience, in which the whole of the facts referring to a definite area were presented as the experience of persons mainly engaged in one class of occupation, namely, "unhealthy trades" (chiefly collieries and iron works).

Finlaison showed as the result of Method No. 1 that financially there is no necessity for discrimination "on the score of indoor or outdoor occupations", but that as regards the contrast of Light and Heavy Labour, the individual in the latter class should contribute for 581 days sickness during working life, to 467 days for one in the former. He also pointed out that the experience of the special classes, namely, mariners, miners, railway servants, and painters, was on the whole in excess of that of the "heavy labour" class, and consequently demanded from these classes a still further augmented contribution. The restricted definition of "Sickness" in this Investigation has probably engendered doubts as to the validity of these results,

but I am disposed to believe that as a matter of comparison *inter se* they were essentially correct.

Method No. (2) will of course be considered correct so far as it goes, but it will generally be admitted that whilst the experience of miners should be separately examined, that of other special classes should also be investigated.

[The comparison of Methods (1) and (2) raises the question of aggregate or select tables in a novel form, Finlaison having excluded his special classes from the general mass while Ratcliffe has followed the opposite plan. I discuss this point at a later stage.]

In Method (3) Mr. Sutton has suggested an expedient which, if generally applicable, would be of great utility. But as Mr. G. F. Hardy has said (*J.I.A.*, xxxiii, 272), the "Welsh rates of sickness and mortality . . . do not show those divergencies from the general table which will perhaps be "expected", and I may supplement Mr. Hardy's comparison by pointing out that Ratcliffe's Miners' and Colliers' Sickness rates, 1866-70, are in excess of Mr. Sutton's Welsh rates, at all ages from 25 to 65, the proportion at 40 being as 1.732 (Ratcliffe) to 1.376 (Sutton), a difference of about 25 per-cent of the latter.

Having reason to believe that the present sickness rates amongst miners, and probably amongst iron, steel and tin-plate workers in South Wales, are at least equal to those shown by Ratcliffe's Colliers' Experience, I have been unable to satisfy myself that Mr. Sutton's Welsh Experience is so largely a "Hazardous occupation" standard, as might be supposed. I have examined the Valuation Returns of the Manchester Unity as supplied to 31 December 1896, and find that in Wales on that date the Society named consisted, according to the secretarial descriptions of occupations, of:—

51	Lodges with	5,033	members engaged in	Agriculture.
43	" "	5,411	" "	Agriculture and Miscellaneous occupations (non-hazardous).
36	" "	6,536	" "	Miscellaneous occupations (non-hazardous).
39	" "	5,753	" "	Part Agriculture and part Hazardous occupations (Mining, Quarry work, &c., Iron, Steel, Tinplate, and Railway work).
130	" "	14,357	" "	Mining.
77	" "	12,928	" "	Other hazardous occupations as above.

376 Lodges with 50,018 members in all.

Thus, of some 50,000 members, 20,000 at least were engaged in non-hazardous occupations, and if a similar proportion prevailed throughout the Welsh Experience, fully two-fifths of the data would have to be excluded in order to ascertain the effects of the more dangerous and exhausting trades. I am not aware of any reason for doubting this estimate. The Manchester Unity has, I believe, quite as high a proportion of the persons engaged in the so-called unhealthy trades, as have the mass of friendly societies in Wales, and if the comparison were disturbed by the rejection, by Mr. Sutton, of incorrect returns, I should on the whole expect to find that the excluded data were most numerous amongst the "unhealthy" group, thus leaving the "normal" class in still greater proportion. With the exception, perhaps, of the mining and metal working district of South Wales and Monmouthshire, I doubt whether the experience of any defined locality can be deemed to be absolutely representative of particular classes of risk. Even in this exceptional case it is doubtful whether mining liabilities can defensibly be aggregated with the lesser risks of other occupations, such as iron, steel, and tin-plate work.

In my endeavour to find a useful method of dividing the experience, I was much assisted by the comparative statements of actual and expected claims (numbering 3,581) which had been prepared in connection with the last Valuation of the Lodges of the Manchester Unity. In each case the occupations principally followed by the members were described on the returns, and these were copied on to cards, on which were recorded the relationship borne by the actual sickness cost to that expected by the 1866-70 standard (Rural, Town and City combined). In order to keep the enquiry within reasonable limits, this relationship was stated in three general forms—High, Low, and Normal—signifying, of course, claims above (or below) the expectation, or in approximate agreement therewith. It was found that in the aggregate, 1,965 Lodges had suffered excess of cost, 690 had not reached the expectation, and 926 were not materially above or below it. The cards were then divided into eight classes, corresponding with the occupations believed, from prior observation, to have a more or less favourable influence on health, and the number of cases in each class falling under each of the three degrees of relationship in sickness experience was then ascertained and recorded. These results, with the description



of the eight population classes are shown in Table 15, from which it will be seen that :—

1. The least excess was in the Textile Trade Class, with . . . . . 28 per-cent of cases of excess.

Followed by :—

- |  |    |   |   |
|--|----|---|---|
| 2. The Textile and Miscellaneous, with . . . . .                         | 35 | „ | „ |
| 3. The Agricultural, with . . . . .                                      | 40 | „ | „ |
| 4. The Agricultural and other Non-hazardous, with . . . . .              | 51 | „ | „ |
| 5. Miscellaneous (non-hazardous) in large towns, with . . . . .          | 54 | „ | „ |
| 6. Agricultural and Hazardous, with . . . . .                            | 64 | „ | „ |
| 7. Hazardous occupations of all classes, mining excepted, with . . . . . | 74 | „ | „ |
| 8. Mining, with . . . . .  | 89 | „ | „ |

Some weight may, I think, be attached to these results. They are of course open to criticism, on the ground that the proportion of excess in each class is not shown, but I think I shall be on safe ground in saying, that as a matter of experience the proportionate amount of excess increases with the proportion in the number of cases, and that for example, the average amount of excess per £100 expected is considerably greater in the mining group than in the general group of large towns or in the iron and steel work, railway service, sea-faring, &c., making up the miscellaneous class of hazardous occupations.

Apart from the immediate subject under consideration, Table 15 throws light on one or two important points. It is clear, for instance, that the Manchester Unity sickness, as a whole, is not now measured by the data of 1866–70, and it may be inferred that Sutton's 1876–80 Tables would much more nearly fit the present facts.

(The cause of the universal rise in sickness claims during the last 20 years would, of itself, be a fruitful theme for discussion.)

The practical objections to any minute division of sickness risks are also very distinctly brought out; 219 lodges were composed of persons following one of the most healthy occupations in agriculture, and some of the most unhealthy or hazardous in seafaring, quarry work, and mining. If it is difficult for the actuary making a valuation to apply two or three different measures to the sickness experience of a small society, he will find it infinitely more so to make the members appreciate the difference in contribution rates between their several classes of risk, and to persuade them to adopt alternative



scales to fit their differing liabilities. There are, probably, many members of this Institute who have had experience of the quaint reasons which are solemnly advanced to support the belief of the officials that the actuary is altogether at sea in his ideas of occupation risks, and that, for example, the miners "in our Society" are quite the healthiest class of the membership, whatever may be the case elsewhere.

TABLE 15.

*Manchester Unity Lodges, 1891-95.—Relation of Sickness Cost to the Valuation Standard (Manchester Unity Experience 1866-70, Rural, Town and City Districts combined).—Classification of Lodges according to Occupations.*

Class	Description of Principal Occupations	Total Number of Lodges in the Class	Percentage of the Whole Number Examined	SICKNESS COST					
				High		Normal		Low	
				No. of Lodges	Percentage of the No. of Lodges in the Class	No. of Lodges	Percentage of the No. of Lodges in the Class	No. of Lodges	Percentage of the No. of Lodges in the Class
A	Agriculture . . . . .	621	17	249	40	209	34	163	26
B	Agriculture and Miscellaneous Occupations in the smaller towns connected mainly with the Agricultural Interest . .	866	24	444	51	239	28	183	21
C	Agriculture and Employments involving extra risks or the consequences of exposure to weather (these being mainly Seafaring, Mining, and Quarry Work) . . . . .	219	6	140	64	48	22	31	14
D	Coal-mining and (mainly) dependent Occupations . . . .	381	11	338	89	28	7	15	4
E	Hazardous Occupations (Mining excepted) mainly Iron, Steel, and Tin Plate Works, Railway Service, Seafaring, and Quarry Work. (Many of these Lodges necessarily include a non-hazardous class)	309	9	230	74	49	16	30	10
F	Textile Trades . . . . .	149	4	42	28	61	41	46	31
G	Textile Trades and Miscellaneous	177	5	61	35	69	39	47	26
H	Miscellaneous Occupations in large towns and of (generally) a non-hazardous character . .	859	24	461	54	223	26	175	20
		3,581	100	1,965	55	926	26	690	19

I have already mentioned the element of supervision as one important factor in the outcome of a sickness risk, and, although it is impossible to give weight to it in the construction of Standard Tables, it is interesting to examine this element so far as the facts available will allow. Considering the success with which the position of many small societies is maintained in face of the fluctuations in sickness and mortality inseparable from paucity of numbers, it appears reasonable to suppose that the efficacy of supervision depends, to a great extent, upon the knowledge of both the circumstances and dispositions of the members which the officers are enabled to acquire. Such being assumed (and its truth will scarcely be disputed), it is an easy step to the conclusion that the rates of sickness claim should increase in rough proportion with the number of members, and that the cases of favourable sickness cost should be most numerous amongst the smallest societies and most rare amongst the largest. As a test of this hypothesis the 3,581 schedules comprised in Table 15 were re-grouped in six classes, referring respectively to lodges with under 80 members; 80 and under 150; 150 and under 250; 250 and under 350; 350 and under 500; and 500 and over. The results of this division are shown in Table 16, and will be seen to fully agree with expectation; as the numbers of members increase the proportion of cases of excess of sickness increases also, so that whilst in the first-class—the lodges with fewer than 80 members—the cases of excess were 337 out of 823 under observation, or 41 per-cent, the cases of excess in the sixth class (500 and over) were 97 out of 118, or 82 per-cent.

The methods of distribution used in Tables 15 and 16 (occupations and numbers) are combined in Table 17, in which are accordingly shown the results of an apportionment of lodges according to—

- (1) Number of members.
- (2) The principal occupations followed.

TABLE 16.

*Manchester Unity Lodges, 1891-95.—Relation of Sickness Cost to the Valuation Standard (Manchester Unity Experience, 1866-70, Rural, Town and City Districts combined).—Classification of Lodges according to Numbers of Members.*

Number of Members in the Lodge	Total Number of Lodges in the Group	Percentage of the Whole Number of Lodges	SICKNESS COST					
			High		Normal		Low	
			Number of Lodges	Percentage of the Number of Lodges in the Group	Number of Lodges	Percentage of the Number of Lodges in the Group	Number of Lodges	Percentage of the Number of Lodges in the Group
Under 80 .	823	23	337	41	255	31	231	28
80 to 149 .	1,059	30	543	51	314	30	202	19
150 to 249 .	877	24	504	57	212	24	161	19
250 to 349 .	425	12	278	66	87	20	60	14
350 to 499 .	279	8	206	74	47	17	26	9
500 and over	118	3	97	82	11	9	10	9
	3,581	100	1,965	55	926	26	690	19

The results of this double apportionment are singularly consistent, bearing in mind the large number of classes (48) into which the facts were divided, and amply confirm the conclusions drawn from both the previous tables. It is true that amongst the Textile Classes (F and G) there is no appreciable increase of claims with enlargement of the membership, but these classes are otherwise quite exceptional in showing, amongst occupations, the lowest percentage of cases of sickness excess, notwithstanding that they are situated in the localities where the mortality has been found the heaviest (Lancashire, Cheshire, and the West Riding of Yorkshire).

It may be useful to show the actual numbers of lodges from which the proportions of Table 17 have been obtained, and these are given in Table 18. In the main, and considering the very general confirmation of results, the data seem sufficient to support the inferences which have been drawn, namely, that other things being equal, the sickness claims of friendly societies will vary with—

- (1) The size of the society.
- (2) The degree of risk or hardship involved in the occupations of the members.

TABLE 17.

*Manchester Unity Lodges, 1891-5.—Relation of Sickness Cost to the Valuation Standard (Manchester Unity Experience, 1866-70, Rural, Town, and City Districts combined).—Classification of Lodges according to (1) Numbers of Members, (2) Occupations.*

Number of Members in Lodge	Percentage of Cases of Excess of Sickness Cost amongst the Lodges in each Occupation Group								Percentage of Cases of Normal Sickness Cost amongst the Lodges in each Occupation Group								Percentage of Cases of Low Sickness Cost amongst the Lodges in each Occupation Group							
	F	G	A	B	H	C	E	D	F	G	A	B	H	C	E	D	F	G	A	B	H	C	E	D
Under 80	28	22	22	29	34	57	64	86	42	48	41	36	32	20	23	8	30	30	37	35	34	23	13	6
80 and not exceeding 149	21	45	42	42	51	61	69	86	50	36	33	34	30	25	21	11	29	19	25	24	19	14	10	3
150 "	38	34	47	52	59	62	76	93	30	39	32	27	21	26	15	4	32	27	21	21	20	12	9	3
250 "	25	30	51	69	59	71	87	92	37½	35	27	19	28	17	5	3	37½	35	22	12	13	12	8	5
350 "	33½	50	65	79	71	76	88	95	33½	33	27	15	19	12	4	5	33½	17	8	6	10	12	8	...
500 and over .	100	75	80	85	74	100	90	100	...	...	...	6	19	...	5	...	...	25	20	9	7	...	...	...

For description of Occupation Classes A to H, see Table 15.

TABLE 18.

*Manchester Unity Lodges, 1891-95.—Relation of Sickness Cost to the Valuation Standard (Manchester Unity Experience, 1866-70, Rural, Town, and City Districts combined).—Classification of Lodges according to (1) Numbers of Members, (2) Occupations.*

Number of Members in Lodge	Cases of Excess of Sickness Cost amongst the Lodges in each Occupation Group								Cases of Normal Sickness Cost amongst the Lodges in each Occupation Group								Cases of Low Sickness Cost amongst the Lodges in each Occupation Group							
	F	G	A	B	H	C	E	D	F	G	A	B	H	C	E	D	F	G	A	B	H	C	E	D
Under 80	10	10	40	41	67	20	42	107	15	22	72	52	62	7	15	10	11	14	65	51	66	8	9	7
80 and not exceeding 149	12	16	95	107	103	43	64	103	29	13	74	87	60	18	20	13	17	7	55	62	38	10	9	4
150 "	13	19	66	121	130	35	51	69	10	22	44	63	45	15	10	3	11	15	29	47	44	7	6	2
250 "	2	7	23	83	69	25	33	36	3	8	12	23	32	6	2	1	3	8	10	15	15	4	3	2
350 "	4	6	17	65	61	13	22	18	4	4	7	12	16	2	1	1	4	2	2	5	9	2	2	...
500 and over	1	3	8	27	31	4	18	5	...	...	...	2	8	...	1	...	...	1	2	3	3	...	1	...
	42	61	249	444	461	140	230	338	61	69	209	239	223	48	49	28	46	47	163	183	175	31	30	15

For description of Occupation Classes A to H, see Table 15.



After consideration of the results of Table 15 it was decided to break up the Sickness experience into the following groups :—

CLASS *a*.—*Agriculture* :—

This included only those occupations appertaining to work upon the land, the greater number of the members included being farmers, farm-labourers, and gardeners.

CLASS *b*.—*Outdoor Building Trades, also casual or unskilled outdoor labour* :—

A somewhat comprehensive class: the actual risks are not believed to be greatly above the average in any of these occupations, but there is much uncertainty as to the continuity of employment, and the class is on the whole migratory. These causes produce special risks (well understood by friendly society officials), and it appeared likely that the rates of sickness claim would be something above the average.

CLASS *c*.—*Railway Service* :—

The liability to accidents and consequences of exposure to weather constitute the special risk of this class. Many railway employments also demand a high standard of physical capability, resulting in suspension of work and consequent sickness claims for causes which would seldom militate against the continuance of less exacting occupations. It may further be said that insurances as a rule are high in comparison with wages, this being always a difficult feature in the administration of a sickness risk.

CLASS *d*.—*Seafaring, Fishing, &c.*

CLASS *e*.—*Quarry work* :—

It is possible that in these occupations less is to be feared from risk of accidents than from the consequences of exposure to the extremes of weather. Quarry workers, too, it is asserted (probably with good reason), are specially liable to bronchial affections, induced by the constant inhalation of particles of stone and slate.

CLASS *f*.—*Iron, Steel, Chemical, and Glass Work* :—

Occupations generally demanding great physical exertion, attended by more or less risk, and frequently involving exposure to intense heat or other trying atmospheric conditions.

CLASS *g*.—*Mining Occupations*, chiefly underground, but including some on the pit brow.

CLASS *h*.—*Miscellaneous Occupations in Rural Lodges*.

CLASS *j*.—*The same in Urban Lodges*.

The number of persons in each of these classes in the locality groups I, II, and III, is shown in Table 19.

TABLE 19.

*Classification of Trades in 300 Lodges of the Manchester Unity, 1893-97.*

The Groups I, II, and III are those employed in the Mortality Investigations. (See Table 6.)

Occu- pations of Class	NUMBER AND PERCENTAGE OF MEMBERS INCLUDED IN THE CLASS							
	Group I		Group II		Group III		Aggregate	
	Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent
<i>a</i>	5,613	22	1,366	7.1	2,298	10.1	9,277	13.7
<i>b</i>	2,706	10.6	2,445	12.7	2,201	9.7	7,352	10.9
<i>c</i>	689	2.7	650	3.4	878	3.9	2,217	3.3
<i>d</i>	313	1.2	337	1.7	304	1.3	954	1.4
<i>e</i>	253	1.0	80	.4	45	.2	378	.6
<i>f</i>	916	3.6	1,278	6.6	1,354	5.9	3,548	5.2
<i>g</i>	188	.8	1,171	6.1	1,461	6.4	2,820	4.2
<i>h</i> )	14,802	58.1	11,957	62	14,240	62.5	40,999	60.7
<i>j</i> )								
	25,480	100	19,284	100	22,781	100	67,545	100

It had to be determined, having settled the groups, whether in the general classes *h* and *j* the whole of the data should be included (Ratcliffe's method), or whether the special classes, which were being dealt with separately, should be excluded on the plan followed by Finlaison.\* The objection to the inclusion of the special classes in one aggregate table was that none of such classes could be said to represent, in all circumstances, anything like a fixed proportion of the whole data. Table 19 showed that the more hazardous trades were very unevenly distributed over the several geographical areas, and it might be easy, on comparing

\* In Ratcliffe's investigation of 1856-60, a comparison was made of the general tables on the bases of (1) miners included, (2) miners excluded, the difference being found to be insignificant. This result, however, was obviously due to the circumstance that the miners represented less than six per-cent of the lives at risk.

aggregate results, to ascribe to geographical causes such differences as resulted entirely from the variable proportions borne by the special occupation classes to the whole mass. On the other hand, it was noticed that, in respect of some of the smaller of the special classes, a great part of the experience came from a disproportionately large number of lodges of which each contributed a quite insignificant number of facts, and it was felt that a general table, to be of practical value, ought to include such cases. Class *c* was especially noticeable in this respect, it being quite a usual thing for a rural Lodge to include two or three railway men; it would be impossible in any actual conditions of working to recognize the extra risk of these exceptional cases, and it would seem necessary that the Standard tables should be framed to meet the conditions as they exist, and so enable any such Lodge to be dealt with as a whole. It was ultimately decided as a compromise between these opposing conditions, to exclude the experience of any special class from the general table in all cases in which the number of lives in such class exceeded 10 per-cent of the whole, and in all other cases to include the entire experience in the general class. On this basis the figures of Group I in Table 19 (comprising 100 Lodges) were re-apportioned, and the expected sickness claims of each class (based on the Manchester Unity 1866-70 combined standard) were obtained and compared with the scheduled experience. The results thus obtained in respect of classes *a*, *b*, *h*, and *j*, will be found in Table 20.

The experience of classes *c* to *g* was too small for useful comparison, but in order to test the supposition of extra risk as far as possible, the data drawn from Group I were supplemented by the experience of some 40 Lodges, in Groups II and III, chosen indiscriminately from the districts in which any of the particularized trades were largely followed. The actual and expected claims for the classes *c* to *g* thus obtained are shown in Table 20*a*.

The experience of classes *f* and *g* shows traces of the form of excess which would be expected in cases where liability to accident accompanies the effects of exhausting toil, namely, a constant, plus a percentage on the normal rate. It may, perhaps, be possible, eventually, to resolve the excess of some of the special classes into general expressions, and so reduce the number of working tables. I am not, however, yet in a position to follow up this theory.

TABLE 20.

*Expected and Actual Weeks of Sickness in 100 Lodges, Manchester Unity, 1893-97 (classified by occupations).*

Class <i>a</i> (Agriculture)										
Ages	Exposed to Risk	Expected Weeks			Actual Weeks			Ratio of Actual to Expected		
		First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months
Under 35	10,135	7,216	439	493	6,767	500	697	·94	1·01	1·59
35-55	6,808	7,161	954	1,938	6,770	1,204	3,557	·95	1·26	1·84
55-70	2,482	5,670	1,486	4,137	4,235	1,355	5,469	·75	·91	1·32
70 & over	765	3,017	1,570	7,469	2,131	1,138	11,219	·71	·73	1·50
	20,190	23,064	4,503	13,983	19,903	4,197	20,942	·86	·93	1·50
Class <i>b</i> (Outdoor Building Trades and "General" Labourers)										
Under 35	3,200	2,296	162	151	2,693	207	166	1·17	1·28	1·10
35-55	3,092	3,276	440	898	4,263	743	1,914	1·30	1·69	2·13
55-70	1,035	2,363	619	1,724	2,336	597	4,017	·99	·96	2·33
70 & over	273	1,085	533	2,434	645	504	4,149	·59	·95	1·71
	7,600	9,020	1,754	5,207	9,937	2,051	10,246	1·10	1·17	1·97
Class <i>c</i> (Miscellaneous, Rural)										
Under 35	22,873	16,388	1,154	1,063	15,195	1,209	1,691	·93	1·05	1·59
35-55	19,968	21,187	2,853	5,821	18,861	2,687	9,816	·89	·94	1·69
55-70	6,743	15,456	4,062	11,322	12,354	4,158	18,975	·80	1·02	1·68
70 & over	1,825	7,211	3,738	17,749	5,168	2,852	29,423	·72	·76	1·66
	51,409	60,242	11,807	35,955	51,578	10,906	59,905	·86	·92	1·67
Class <i>j</i> (Miscellaneous, Urban)										
Under 35	7,509	5,390	382	356	5,423	392	739	1·01	1·03	2·08
35-55	7,002	7,371	983	1,997	7,606	1,217	2,528	1·03	1·24	1·27
55-70	2,072	4,611	1,180	3,253	4,416	1,251	7,907	·96	1·06	2·43
70 & over	237	938	471	2,182	1,043	544	4,430	1·11	1·16	2·03
	16,820	18,310	3,016	7,788	18,488	3,404	15,604	1·01	1·13	2·00

TABLE 20a.

*Expected and Actual Weeks of Sickness.—Unhealthy and Hazardous Occupations.*

Class c (Railway Service)										
Ages	Exposed to Risk	Expected Weeks			Actual Weeks			Ratio of Actual to Expected		
		First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months
Under 35	1,760	1,262	88	81	1,826	165	208	1·45	1·88	2·56
35-55	1,497	1,568	208	421	1,731	314	804	1·10	1·51	1·91
55-70	235	513	136	353	437	82	757	·85	·63	2·15
70 & over	41	164	82	381	226	131	460	1·38	1·60	1·21
	3,533	3,507	514	1,236	4,220	692	2,229	1·20	1·35	1·80
Class d (Seafaring)										
Under 35	859	617	45	41	352	...	...	·57	...	...
35-55	931	1,032	147	306	978	202	351	·95	1·37	1·15
55-70	469	1,047	268	741	925	361	2,388	·88	1·35	3·22
70 & over	91	357	178	815	256	136	1,669	·72	·76	2·05
	2,350	3,053	638	1,903	2,511	699	4,408	·82	1·10	2·32
Class e (Quarry-work)										
Under 35	625	448	31	28	631	28	46	1·41	·90	1·64
35-55	383	393	51	102	462	85	141	1·18	1·67	1·38
55 & over	29	64	24	98	100	52	306	1·56	2·17	3·12
	1,037	905	106	228	1,193	165	493	1·32	1·56	2·16
Class f (Iron and Steel Workers, &c.)										
Under 35	3,056	2,190	154	142	2,931	219	272	1·34	1·42	1·92
35-55	2,932	3,085	411	836	3,954	667	2,346	1·28	1·62	2·81
55-70	841	1,924	505	1,404	1,968	499	2,243	1·02	·99	1·60
70 & over	198	781	419	1,947	611	407	4,553	·78	·97	2·34
	7,027	7,980	1,489	4,329	9,464	1,792	9,414	1·19	1·20	2·17
Class g (Mining)										
Under 35	5,556	3,959	272	244	8,821	708	1,433	2·23	2·60	5·87
35-55	3,592	3,714	485	974	7,269	1,483	4,960	1·96	3·06	5·09
55-70	924	2,082	540	1,494	2,814	863	5,961	1·35	1·60	4·00
70 & over	135	533	274	1,292	470	316	2,485	·88	1·15	1·93
	10,207	10,288	1,571	4,004	19,374	3,370	14,839	1·88	2·15	3·71



TABLE 21.

*Adjusted Ratios of Sickness Rates to the Standard Table (Manchester Unity, 1866-70, Rural, Town, and City Districts combined).*

Ages	RURAL, CLASSES <i>a</i> AND <i>h</i>			URBAN, CLASS <i>j</i> <sup>e</sup>			OUTDOOR TRADES AND CASUAL LABOUR CLASS <i>b</i>			UNHEALTHY AND HAZARDOUS OCCUPATIONS, CLASS <i>f</i>			MINING OCCUPATIONS, CLASS <i>g</i>		
	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months
16-24	.95	1.00	1.60	1.00	1.00	2.00	1.20	1.50	1.00	1.35	1.50	2.00	2.00	2.50	6.00
25-34	.90	1.00	1.60	1.00	1.05	2.00	1.20	1.50	1.50	1.35	1.50	2.00	2.00	2.50	5.50
35-44	.90	1.00	1.65	1.00	1.10	2.00	1.20	1.50	2.00	1.30	1.50	2.25	2.00	2.50	5.00
45-54	.90	1.00	1.70	1.00	1.15	2.00	1.20	1.30	2.00	1.20	1.50	2.25	2.00	2.20	4.50
55-64	.85	1.00	1.65	1.00	1.15	2.00	1.10	1.10	2.00	1.10	1.20	2.25	1.60	1.90	4.00
65-74	.75	.90	1.60	1.00	1.15	2.00	1.00	1.00	2.00	1.00	1.00	2.25	1.20	1.50	3.00
75 & } over }	.70	.70	1.60	1.00	1.15	2.00	.70	1.00	2.00	.80	1.00	2.25	.90	1.20	2.00

The basis of experience on which Tables 20 and 20a have been prepared is, of course, slender, but the results shown in respect of the larger classes, at least, are consistent with expectation, and may be taken to indicate, in a general manner, the relative sickness risks of the several classes. Regarding them in this light, and freely adjusting to remove irregularities, a table of relations has been prepared (Table 21, page 299), and, in conjunction with similar mortality relations (Table 22) deduced from the experience examined earlier in this paper, has been employed to test the financial effect of the several departures from the standard. It will be observed in Table 20 that the Classes *a* and *h* are very much alike in sickness experience, and these classes have, in the following tables, been accordingly amalgamated, the result being a composite class of rural life embracing all occupations, but sufficiently limiting those involving extra risk to fit the experience to a normally constituted rural society.

TABLE 22.

*Adjusted Ratios of Mortality Rates to the Standard Table (Manchester Unity 1866-70, Rural, Town, and City Districts combined).*

Age	Group I, Rural	Group II, Urban	Group III, Urban
24	·55	·70	·60
34	·60	·85	·80
44	·70	1·00	·90
54	·75	1·10	1·05
64	·80	1·20	1·10
74	·85	1·33	1·10
Over 74	·90	1·33	1·10

For the purpose of ascertaining the several reserves at various stages of a society's existence, say, at the end of 20, 40, and 70 years, a representative society was constructed by combining the membership of a number of lodges opened in the years 1875, 1855, and 1825 respectively, the returns of which were made up as at 31 December 1895. The average number of members per lodge was about 200, and the total number in each group approximately 2,900.

The distribution of the membership by age is as follows:—

TABLE 23.

*"Representative Society."*

Ages	AGE OF SOCIETY 20 YEARS		AGE OF SOCIETY 40 YEARS		AGE OF SOCIETY 70 YEARS	
	Number of Members	Percentage of the Whole	Number of Members	Percentage of the Whole	Number of Members	Percentage of the Whole
16-25	879	30·2	595	20·8	564	19·1
26-35	1,221	42·1	799	28	656	22·3
36-45	603	20·7	667	23·3	596	20·2
46-55	163	5·6	489	17·1	569	19·3
56-65	38	1·3	267	9·3	361	12·3
Over 65	3	·1	42	1·5	199	6·8
	2,907	100	2,859	100	2,945	100

The benefits assumed by the valuations were 10s. per week for the first 26 weeks of sickness, 5s. per week for the next 26 weeks, and 2s. 6d. per week for the remainder of incapacity, and £10 at death. The contribution was taken at the uniform rate of 16s. per annum, this being the equivalent of the benefits, on the 1866-70 standard, at about age 21.

The values at 3 per-cent of these benefits and contributions, with the resulting net liabilities, are shown in Tables 24, 25, and 26 (see pp. 319, 320). The bases of valuation employed and referred to in these tables by the numbers in the first column are as follows:—

1. Mortality, Rural Class of Group I, Sickness Rural (Classes *a* and *b*).
2. " " " " Building and other Outdoor Trades, agricultural excepted, and Casual Labour (Class *b*).
3. " Urban Class of Group II, " Miscellaneous Urban occupations (Class *j*).
4. " " " " as 2 (Class *b*).
5. " " " " Unhealthy and hazardous, mining excepted (Class *f*).
6. " " " " Mining (Class *g*).
7. " Urban Class of Group III " as 3 (Class *j*).
8. " " " " as 4 (Class *b*).
9. " " " " as 5 (Class *f*).
10. " " " " as 6 (Class *g*).
11. " and Sickness, Manchester Unity, 1866-70 (Rural, Town, and City Districts combined).

In each of the cases 1-10 sickness is assumed to become constant at the lowest rate of pay at the age of 85; in the 11th case (Manchester Unity, 1866-70) the tabular rates of sickness throughout life are employed.

The net effect of the several variations in sickness and mortality as against the standard, and as against each other, will be shown by the valuation reserves, which are given in the 8th column in each table. The proportionate reserve required by each basis in comparison with £1,000 on the 1866-70 standard is shown by the following table:—

TABLE 27.

*Amount of Reserve on various Bases of Valuation in comparison with £1,000 required by Manchester Unity Tables, 1866-70 (Rural, Town, and City Districts combined). Interest 3 per-cent.*

Basis of Valuation	AGE OF SOCIETY		
	20 Years	40 Years	70 Years
	Comparative Reserve or Net Liability		
	£	£	£
1	1,052	1,068	1,076
2	1,807	1,616	1,538
3	1,207	1,160	1,152
4	1,450	1,275	1,225
5	1,636	1,392	1,327
6	3,256	2,384	2,110
7	1,328	1,263	1,251
8	1,564	1,371	1,316
9	1,760	1,498	1,430
10	3,423	2,514	2,231
11	1,000	1,000	1,000

The differences due to changes in the sickness rates alone are found by comparing the reserves on bases 1 and 2, 3, 4, 5 and 6, and 7, 8, 9 and 10; differences due to changes in mortality alone being shown by comparison of reserves on bases 2, 4 and 8, 3 and 7, 5 and 9, and 6 and 10.

When the wide departures from the standard in sickness and mortality are borne in mind, the difference in these comparative reserves will not excite surprise. The table, might, indeed, occasion some misgivings, on a first inspection, as to the sufficiency of the reserves which are yielded by the Manchester Unity standard, but further examination shows that, except in

the case of the mining group, there is little need for concern on this point. In valuing friendly societies, we are all accustomed, I assume, to take the rate of interest well below that which is actually being obtained, and in cases of extra risk, as indicated by the experience under examination, to substantially load the tabular sickness rates. By combining these adjustments the standard reserves can be varied to any extent, and in Table 28 (page 321) I show, by way of example, the combinations necessary to produce the reserves of bases 1 to 5 and 7 to 9. It is satisfactory to note that few of these involve a more considerable adjustment than it is the custom to adopt.

For different scales of reduction in sickness benefits, different adjustments of the standard values are, of course, required. The adjustments necessary to give the true reserves in cases where the sickness benefits are not reduced beyond the half-pay rate are given in Table 29, p. 322, and it may be understood that these will apply with sufficient approximation whether the reduction takes effect after six or after twelve months, the contribution being premised in each case to be equivalent (on the standard) to the benefits assured for a common entry age of 21. It is worthy of observation that the adjustments required are greater in cases where continuous half sick pay is allowed than where the benefit is eventually reduced to quarter pay, this being due to the circumstance that the bulk of the sickness excess is found in the "after twelve months" period.

I have some hope that the figures given in Tables 24 to 29 may be found of service in valuations. The ground work is necessarily tentative, but the relations of sickness and mortality to the standard, as shown in Tables 21 and 22, will probably correspond with fair approximation to the experience of many societies, as will also the age-distribution of the membership of the representative society at the several stages of its assumed existence; in cases to which these hypotheses apply, Tables 28 and 29 will, possibly, afford a better guide to the required adjustments on the standard, especially in the case of a small society, than can be obtained from the individual experience of the society itself. It is extremely difficult to correctly appreciate the limited and fluctuating experience of an inconsiderable society—to determine which features are permanent and which merely accidental—and in framing the tables named, I have ventured to indulge the expectation that they would, though partially and tentatively, supply such a typical set of deviations as would lessen the need for reliance on the experience of the



particular societies which may be under examination. It will be remembered that deficiencies found on the employment of these adjustments will increase at interest at the rate which is expected to be permanently realized, and not at the lower rate actually used.

I have not attempted to indicate methods of obtaining the liabilities of the mining class, having been deterred by the extraordinary sickness cost of this section. An eminent member of the profession informed us some years ago that he had been compelled, with reluctance and only after conclusive evidence of its necessity, to advise a society not to accept these risks on any terms, and the wisdom of such advice is fully borne out by the figures of Table 20*a*. Many circumstances and especially the migratory habits of the unskilled class preclude, however, the absolute exclusion of miners from the ranks of friendly society membership, and the problem which Mr. R. P. Hardy had to solve in the case of the "Hearts of Oak" is daily presenting itself in cases where his effective solution cannot be applied. The contributions derived from the Manchester Unity Colliers' Experience of 1866-70, although about 30 per-cent above the general rates, are quite insufficient to meet the mining liabilities of the present day, and I fear there is little hope of amelioration of the position by abatement of the claims. In these circumstances, I see no hope of salvation for the friendly societies concerned, unless they can be induced to release themselves from liability in respect of accidents of occupation, and to limit their operations to benefits in actual sickness and at death. The position of the miner has undergone some change, presumably for the better, by the enactment of the Workmen's Compensation Act 1897, and it does not appear unreasonable, the workmen being otherwise provided for, that the societies affected should now relieve themselves of a burden which unmistakably threatens to be their ruin.

#### THE DURATION OF SICKNESS.

From the sickness experiences presented in Tables 20 and 20*a*, it is evident that the present distribution of the claims between the several periods of attack is widely different from the expectation of Ratcliffe's Tables. There is no doubt that, as a measure of the effect of reductions of benefit in cases of prolonged illness, the Manchester Unity Tables of 1866-70 are defective, and the same may apparently be said, though to a less extent, of the later experience of the Foresters' Society, the error being on the safe side in each case. We have now, of course, available the elaborate work of Mr. Sutton, in which it is understood that

the point has received special consideration, and the occasion seems suitable, therefore, for a brief examination of the methods by which an analysis of the kind should proceed. I may point out that although the new Registry Office Experience bears every indication of an accurate distribution, it is not clear from the report that the fundamental requirement, namely, a record of the date of the commencement of sickness, was satisfied in every case. The form exhibited on page xi of the Report would appear, unquestionably, to show the date of commencement of each attack which began in the quinquennial period, but nothing seems to have been asked as to the commencement of those attacks which began before the quinquennial period, and were still continuing on 1 January 1876. The status of the members actually sick at the commencement of the observations, is certainly an important point in such an investigation, and, having regard to the apparent incompleteness of the original schedules in this respect, an authoritative explanation as to the method of classification followed would have been welcome. It is possible that the returns for the previous five years (1871-75) were requisitioned, but these, as Mr. Sutton regretfully pointed out, gave simply the amount of sickness in each year without commencing or terminating dates, and would at best be of doubtful utility. The sicknesses of long standing would readily be discovered by their aid, but in cases of claim commencing in 1875 it would be almost impossible to determine whether the illnesses were terminated during that year or whether they were continued up to 31 December, and so formed part of attacks current on 1 January 1876.

I propose to examine the various methods by which the sickness claims may be distributed in order to show the annual rate of claim in each period of attack. It is not, on the face of things, a difficult matter to apportion every sickness which can be traced from its beginning to its end, but before proceeding to the merely arithmetical work, certain preliminaries have to be dealt with, and these present some scope for difference of opinion and method. The preliminaries of which I speak arise out of the fact that the Societies have elaborated a peculiar but important interpretation of the term "continued sickness", the practice being to account as one continuous attack all claims which are not separated by a non-recipient period of some assigned number of months, generally 6, 12, or 24. As the result of variations in this non-recipient period (dictated sometimes by experience, but often I fear by caprice), it is pretty clear that two or more Societies

experiencing exactly the same quantity of sickness per member at risk, at each age, may be called upon for different amounts of sickness pay, and that if in an actuarial analysis effect be given to the practices respectively obtaining, the experience of a society or group of societies working under one system will show a different apportionment of the claims from that of a similarly constituted group working under another.

The following example of apportionment of an individual case will illustrate the differences resulting from changes in the length of the non-recipient interval. The case quoted is typical of a not inconsiderable class.

## ORIGINAL DATA.

Year	Sickness began	Sickness ended	Weeks	Days
1893	...	...	...	...
1894	February	May	10	1
1895	January September	April October	15 0	3 5
1896	January March October	February March December	1 1 9	... ... 4
1897	January	December	52	1

## APPORTIONMENT A.

*Twelve Months Non-recipient Period required to elapse before return to Full Pay as from beginning of Sickness.*

Year	First 3 Months of Claim	Second 3 Months of Claim	Second 6 Months of Claim	Second 12 Months of Claim	Remainder of Claim (after 2 years)
1893	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>
1894	...	...	...	...	...
1895	10 1	...	...	...	...
1896	2 5	13 0	0 3	...	...
1897	...	...	11 4	...	...
	...	...	13 5	38 2	...
	13 0	13 0	26 0	38 2	...

## APPORTIONMENT B.

*Six Months Non-recipient Period required to elapse before return to Full Pay as from beginning of Sickness.*

Year	First 3 Months of Claim	Second 3 Months of Claim	Second 6 Months of Claim	Second 12 Months of Claim	Remainder of Claim (after 2 years)
	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>
1893	...	...	...	...	...
1894	10 1	...	...	...	...
1895	13 0	3 2	...	...	...
1896	9 4	2 0	...	...	...
1897	3 2	13 0	26 0	9 5	...
	36 1	18 2	26 0	9 5	...

## APPORTIONMENT C.

*No Fixed Period of Non-receipt of Benefit required to separate Claims.*

Year	First 3 Months of Claim	Second 3 Months of Claim	Second 6 Months of Claim	Second 12 Months of Claim	Remainder of Claim (after 2 years)
	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>	<i>w. d.</i>
1893	...	...	...	...	...
1894	10 1	...	...	...	...
1895	13 5	2 3	...	...	...
1896	11 4	...	...	...	...
1897	3 2	13 0	26 0	9 5	...
	39 0	15 3	26 0	9 5	...

Data drawn from a large body of Societies such as those furnishing the "Males 1876-80" Experience, or the branches of a great affiliated order will include the experience of organizations working under every variety of this regulation, and for this reason a record of claims under the several rates of benefit as actually paid (a form of return which might conveniently and accurately be adopted if the practice of the constituent Societies were uniform) can be of but little service. All that can be usefully required in the returns is the date of the beginning of sickness, the date of its ending, and the duration of the attack, leaving it to the actuary to make his own apportionment into the several periods of claim. In deciding on the system to be followed in this apportionment it would naturally be desired to follow the rule adopted by the greatest number amongst the Societies contributing the data.

As a test of the several working rules which may be adopted, I have analyzed on the three assumptions employed in the foregoing examples the experience (in 1893-97) of 100 Lodges selected from all parts of the United Kingdom.

The assumptions employed were, as stated in the examples:—

- (a) That all attacks between which twelve months clear of benefit did not elapse were to be considered as “continuous.”
- (b) That all attacks between which six months clear did not elapse were to be so considered.
- (c) That each attack was to be considered a separate sickness, without regard to the time elapsed since the benefit was last drawn.

The periods chosen for tabulation as those likely to be most serviceable were the first 13 weeks of sickness, second 13 weeks, second 26 weeks, second 52 weeks, and remainder of sickness after two years.

It will not be necessary to give the results of these apportionments in detail, the following summaries showing their respective effects. I have added the “Expected weeks” by Sutton’s “1876-80” Tables, in order to test the general character of the experience, and from this it will be observed that as against a total of 156,824 weeks of sickness “Expected”, there were actually experienced 159,925 weeks. There is a striking similarity between the distribution of the “Expected” sickness and that of the Actual sickness on apportionment C, this in some measure suggesting that in his analysis, Mr. Sutton assumed that every fresh attack began a new sickness, without regard to the period elapsed since the last claim.

TABLE 30.

*Summary of Apportionments (100 Lodges of the Manchester Unity, 1893-97).*

Period of Claim	Method A	Method B	Method C	Expected Weeks Males, 1876-80
First 3 Months	62,832	68,105	72,153	70,235
Second 3 Months	14,303	12,884	11,677	13,221
Second 6 Months	13,976	12,351	11,219	11,844
Second 12 Months	15,896	14,666	13,877	13,613
Remainder, (after two years) . .	52,918	51,919	50,999	47,371
	159,925	159,925	159,925	156,284



It will be apparent from the above summaries that in Methods B and C, as compared with Method A, there is an appreciable shifting of claims from the after periods into the first 3 months of sickness. The effect of this will be more readily seen from comparing the cost on the three methods, and this I have done, taking the scale of benefits as £1 per week for the first 3 months, 15s. per week for the second 3 months, 10s. per week for the second 6 months, and 5s. per week for the remainder of sickness.

On this basis the cost by Method A is £97,750,

                  "                  "                  "                  B is 100,590,

                  "                  "                  "                  C is 102,740,

the excess of cost by Method B over Method A being thus roughly 3 per-cent of either, and by Method C, 5 per-cent. If the 159,925 weeks had been distributed in the same proportion as the 156,284 weeks expected by Mr. Sutton's Tables, the cost would have been £103,677, being greater than even that under Method C. This relative excess of cost in the case of Mr. Sutton's Tables is, to say the least, interesting, and in order to satisfy enquiry as to its incidence I have constructed Table 31, p. 310, which shows the proportionate distribution by each method at successive groups of ages, the distributions by Mr. Sutton's Tables and by the Manchester Unity Experience (as corrected by Mr. G. F. Hardy) being also given. The two last are of interest if taken by themselves, the more recent experience being found to give a lower proportion of sickness in the first 6 months, and a higher proportion in the "after 12 months" period than the Manchester Unity Tables, even as corrected. When compared with the special experience which I have collated, Mr. Sutton's Tables show very fair agreement with the apportionment on Method C throughout, such differences as exist arising probably from the somewhat limited extent of my data. For example, in the age group 50-54, I show considerably less sickness in the first period and more in the third than does the Friendly Societies Experience, and the same at 60-64 and 65-69, but in each case there is a palpable irregularity in my proportions as compared with those immediately above and below them which would disappear on any ordinary graduation.

TABLE 31.

DISTRIBUTION OF SICKNESS CLAIMS, 100 LODGES OF THE MANCHESTER UNITY									
Age	Apportioned with 12 Month's Interval for Non-continuous Sickness Method A			Apportioned with 6 Months' Interval for Non-continuous Sickness Method B			Apportioned without Interval for Non-continuous Sickness Method C		
	Percentage of Claims falling in			Percentage of Claims falling in			Percentage of Claims falling in		
	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months
16-19	97.2	2.8	...	97.4	2.6	...	97.4	2.6	...
20-24	90.3	3.7	6.0	90.8	3.2	6.0	91.6	2.7	5.7
25-29	82.9	8.2	8.9	84.8	6.7	8.5	85.9	6.5	7.6
30-34	82.5	7.2	10.3	83.9	6.0	10.1	86.4	4.6	9.0
35-39	70.0	9.8	20.2	72.9	8.3	18.8	75.8	7.0	17.2
40-44	68.1	8.6	23.3	70.7	7.9	21.4	72.0	7.3	20.7
45-49	61.3	8.9	29.8	63.2	7.5	29.3	65.2	6.4	28.4
50-54	49.3	7.6	43.1	51.0	6.6	42.4	53.0	5.7	41.3
55-59	48.2	10.8	41.0	51.8	8.6	39.6	53.9	7.4	38.7
60-64	35.7	10.9	53.4	39.5	9.5	51.0	41.5	8.4	50.1
65-69	22.4	8.8	68.8	25.0	8.5	66.5	26.6	8.3	65.1
70-74	21.4	11.5	67.1	24.6	10.2	65.2	26.4	10.1	63.5
75-79	13.6	8.3	78.1	16.4	8.5	75.1	18.0	8.3	73.7
80-84	8.6	5.9	85.5	9.3	5.7	85.0	9.6	5.6	84.8
85-89	5.9	5.8	88.3	7.2	5.0	87.8	9.0	5.0	86.0
90-94	...	...	...	...	...	100.0	...	...	100.0
DISTRIBUTION OF FRIENDLY SOCIETIES (1876-80) EXPERIENCE (Sutton's Tables)									
Age	Percentage of Claims falling in			Percentage of Claims falling in			Percentage of Claims falling in		
	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months	First 6 Months	Second 6 Months	After 12 Months
	88.1	5.0	6.9	87.0	4.9	8.1	84.7	5.5	9.8
16-19	...	...	...	...	...	...	...	...	...
20-24	91.5	5.4	3.1	87.3	6.0	6.7	82.2	7.0	10.8
25-29	87.3	6.0	6.7	79.5	5.8	14.7	74.8	6.3	18.9
30-34	7.0	10.8	14.8	73.2	8.1	18.7	66.0	8.7	25.3
35-39	18.7	25.3	30.3	60.4	9.3	30.3	53.5	8.7	37.8
40-44	45.49	55.59	60.64	46.2	10.5	43.3	38.5	11.2	50.3
45-49	55.59	65.69	70.74	27.2	9.7	63.1	18.4	...	...
50-54	75.79	80.84	85.89	...	...	...	...	...	...
55-59	85.89	90.94	...	...	...	...	...	...	...
60-64	...	...	...	...	...	...	...	...	...
65-69	...	...	...	...	...	...	...	...	...
70-74	...	...	...	...	...	...	...	...	...
75-79	...	...	...	...	...	...	...	...	...
80-84	...	...	...	...	...	...	...	...	...
85-89	...	...	...	...	...	...	...	...	...
90-94	...	...	...	...	...	...	...	...	...

DISTRIBUTION OF  
MANCHESTER UNITY (1866-70)  
EXPERIENCE (corrected rates,  
G. F. Hardy, J.L.A., xxvii, 289)

DISTRIBUTION OF FRIENDLY  
SOCIETIES (1876-80)  
EXPERIENCE  
(Sutton's Tables)

Apportioned with 12 Month's  
Interval for Non-continuous  
Sickness  
Method A

Apportioned with 6 Months'  
Interval for Non-continuous  
Sickness  
Method B

Apportioned without  
Interval for Non-continuous  
Sickness  
Method C

Percentage of Claims  
falling in

First 6 Months

Second 6 Months

After 12 Months

First 6 Months

Second 6 Months

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For the purpose of ascertaining the effect of each method on the values of sickness benefits, and therefore on reserves, I have deduced the following table of differences, which I think is fairly warranted by Table 31.

TABLE 32.

*Apportionment of Sickness Claims.*

Ages	METHOD B AS COMPARED WITH METHOD A					METHOD C AS COMPARED WITH METHOD A				
	Percentage of Whole Quantity of Sickness transferred					Percentage of Whole Quantity of Sickness transferred				
	To First 3 Months	From Second 3 Months	From Second 6 Months	From Second 12 Months	From After 2 Years	To First 3 Months	From Second 3 Months	From Second 6 Months	From Second 12 Months	From After 2 Years
16-19	·5	·5	...	...	...	1·0	·5	·5	...	...
20-24	1·5	1·0	·5	...	...	4·0	3·0	1·0	...	...
25-29	3·0	1·5	1·5	...	...	6·0	3·0	2·0	1·0	...
30-34	3·5	1·5	1·5	·5	...	7·0	3·0	2·5	1·0	·5
35-39	4·0	1·5	1·5	1·0	...	7·0	2·5	2·5	1·5	·5
40-44	4·0	1·5	1·5	1·0	...	7·0	2·5	2·5	1·5	·5
45-49	4·0	1·5	1·5	1·0	...	7·0	2·5	2·5	1·5	·5
50-54	4·0	1·0	1·5	1·0	·5	7·0	2·0	2·5	1·5	1·0
55-59	4·0	1·0	1·5	1·0	·5	7·0	2·0	2·5	1·5	1·0
60-64	4·0	·5	1·5	1·0	1·0	6·5	1·5	2·0	1·5	1·5
65-69	3·5	·5	1·0	1·0	1·0	5·5	·5	1·0	1·5	2·5
70-74	3·0	..	1·0	1·0	1·0	5·0	·5	·5	1·5	2·5
75-79	2·0	..	·5	·5	1·0	4·0	..	..	1·5	2·5
80-84	1·0	..	...	...	1·0	2·0	..	..	...	2·0
85-89	1·0	..	...	...	1·0	2·0	..	...	...	2·0

Employing these percentages, and taking the scale of benefits set out above, I find that the differences in value between the sickness benefits on the three methods are as shown in the following table, the values of the complete benefit at each age as given by Sutton's Tables (1876-80) being added for comparison.

TABLE 33.

Age	EXCESS OF SICKNESS LIABILITY *			Value of Total * Sickness Benefits (on Friendly Societies 1876-80 Experience)
	Method B over Method A	Method C over Method B	Method C over Method A	
20	£ ·81	£ ·65	£ 1·46	£ 30·71
40	1·34	·98	2·32	39·48
60	2·00	1·45	3·45	50·39
80	1·04	1·03	2·07	47·15

Taking a Society of 212 members, established nearly 40 years and having contributors at ages from 20 to 72, the value of sickness benefits on the above scale by the 1876-80 Experience is £7,988, whilst the value of the differences between Methods B and A is £262, between B and C £197, and between A and C £459. If the age at entry of all the members be taken as 20 and the contribution paid the equivalent of the benefits granted at that age, namely, £1. 7s. 7d. per annum (Sutton's Tables), the net liability on the Standard is £2,712, and on this the differences represent a proportion between A and B of 9·7 per-cent; between B and C of 7·3 per-cent; between A and C of 17·0 per-cent.

These then are the differences on valuation, in a fairly chosen case, resulting from the possible variations in the method of collating the basis facts. All three methods used are, as I conceive, admissible, though Method C is not in agreement with the common practice of Friendly Societies. To judge by the little attention this phase of the subject has hitherto received, these differences would appear to be greater than have been anticipated; however this may be, I venture to think that they establish the need for explanation by the actuary of the interpretation placed by him on "continuous sickness", and for the stipulation that the adoption of other rules in practice will probably lead to departures from the Standard results. The tables above given may afford some indication of the expected divergence under such conditions, and may be of service as showing the approximate adjustment to be made to table values constructed on one method when employed to measure liabilities accruing under another. Having regard to this possible usefulness

\* Sickness Benefits £1 per week for the first 13 weeks, 15s. per week for the second 13 weeks, 10s. per week for the second 26 weeks, and 5s. per week for the remainder.

of my results, I may claim for them that they do not overstate the differences which they demonstrate—rather indeed the reverse, seeing that from the impossibility of going back into history in every individual case I have had to assume that members who were not actually in receipt of benefits at the commencement of the observations, were entitled, on their first claim in 1893, to enter on full pay unfettered by any allowances received by them in 1892. From experiments made in a few cases where more extensive data were available, this is, I believe, a quite unimportant point, and the assumption made is in any case on the safe side. In respect of cases of sickness current on 1 January 1893, I obtained the actual commencing date of those which began in 1891 and 1892, being content in cases of longer standing than two years with a simple statement that the sickness began before 1891.

It should be explained that in apportioning the sickness claims exhibited in Tables 20 and 20*a*, I have adopted a non-recipient period of 12 months, this being the interval required by a large proportion of the Lodges of the Manchester Unity.

#### SECESSIONS.

I need scarcely hesitate to say that, in dealing with the element of secession, I have found myself confronted with unusual difficulties. It may be said that two alternative methods, the “aggregate” and “select”, have hitherto received support, but whilst the first is generally discredited (and rightly so) as being unsafe, especially when employed in connection with societies which admit new members up to 40 or 45 years of age, the second is in practice inadmissible, by reason of the multiplicity of tables which it involves.

I have accordingly been led to consider whether ordinary requirements could not be satisfied by a modification of the “aggregate” method. It appears to me that our needs would be met substantially by a table of secession rates proceeding by age alone, if such rates were deduced from an experience extending over a long period (say 20 years) from which the facts relating to lives admitted during the period had been wholly excluded. Such a table would show the departures in every year of age from the members who were on the books at the beginning of the period under observation, and if a representative body of experience had been employed, might be assumed to indicate the departures



to be expected age by age in a normally constituted Society during a similar period following any given date. The exclusion of the facts relating to entrants during the period would of course reduce the observed rates of secession, and the employment of the experience of some such long period as 20 years would give the required minimum weight to the withdrawals amongst the members who had been enrolled immediately prior to the commencement of the observations.

I have not at present obtained any experience going back so far as 20 years (which I suggest as a convenient period for observation), although I do not expect any difficulty on that point, should it ultimately be decided that this expedient may be profitably adopted, but the following tables show the effect of this plan on the secession rates in cases where the observations were limited to 9 years and 5 years respectively. In explanation of the early age at which the "class" rates combine in Table 34, it should be said that members are not accepted in this particular branch after the age of 35.

TABLE 34.

*Widows' and Orphans' Fund, South London District, I.O.O.F.,  
M.U.—Secession Experience in the Nine years, 1887-95.*

Ages	EXPOSED TO RISK			NUMBER OF SECESSIONS			RATE OF SECESSION EXPERIENCED (per-cent)		
	All Members	Entrants before 1887	Entrants 1887-95	All Members	Entrants before 1887	Entrants 1887-95	All Members	Entrants before 1887	Entrants 1887-95
16-19	836	80	756	91	12	79	10·9	15·0	10·5
20-24	7434·5	2266	5168	1,096	304	792	14·7	13·4	15·3
25-29	11415	7008	4407	958	472	486	8·4	6·7	11·0
30-34	10607	9059	1548	481	374	107	4·5	4·1	6·9
35-39	8151	7700	451	197	186	11	2·4	2·4	2·4
40-44	6509	6464	45·5	110	109	1	1·7	1·7	2·2
45-49	5529	5529	...	62	62	...	1·1	1·1	...
50-54	4036·5	4036·5	...	45	45	...	1·1	1·1	...
55-59	2845·5	2845·5	...	23	23	...	·8	·8	...
60-64	2056·5	2056·5	...	27	27	...	1·3	1·3	...
65-69	1611·5	1611·5	...	19	19	...	1·2	1·2	...
70-74	1162	1162	...	16	16	...	1·4	1·4	...
75-79	662	662	...	18	18	...	2·7	2·7	...
80-84	212	212	...	4	4	...	1·9	1·9	...
85-90	22	22	...	...	...	...	...	...	...
90-94	2	2	...	...	...	...	...	...	...
	63091·5	50716	12375·5	3,147	1,671	1,476	5·0	3·3	11·9

TABLE 35.

*Secession Experience of 100 Lodges of the Manchester Unity in the Five years 1893-97.*

Ages	EXPOSED TO RISK			NUMBER OF SECESSIONS			RATE OF SECESSION EXPERIENCED (per-cent)		
	All Members	Entrants before 1893	Entrants 1893-97	All Members	Entrants before 1893	Entrants 1893-97	All Members	Entrants before 1893	Entrants 1893-97
16-19	4765·5	816·5	3949	149	38	111	3·13	4·65	2·81
20-24	15648	8947·5	6700·5	833	466	367	5·34	5·21	5·48
25-29	15281	12946	2335	662	513	149	4·33	3·98	6·37
30-34	14025·5	12942	1083·5	388	318	70	2·77	2·46	6·48
35-39	11971	11485·5	585·5	231	190	41	1·92	1·65	7·00
40-44	9884	9609·5	274·5	129	107	22	1·31	1·11	8·00
45-49	8553·5	8489·5	64	79	76	3	·92	·90	4·69
50-54	7568·5	7568·5	...	37	37	...	·49	·49	...
55-59	6012	6012	...	31	31	...	·52	·52	...
60-64	4067	4067	...	8	8	...	·20	·20	...
65-69	2304	2304	...	5	5	...	·22	·22	...
70-74	1662·5	1662·5	..	7	7	...	·42	·42	...

The increasing rates of withdrawal amongst the members admitted during the period is an interesting feature of this Table, but whether any significance is to be attached to it can only be determined by a more extensive series of observations.

It may be presumed that in such an experience as I suggest the rate of secession at each age would diminish, year by year, as the average period of membership of the survivors to the age increased. This would tell against the expedient proposed, inasmuch as the employment of a constant annual rate of lapse at each age would involve the unfounded assumption that a proportion of the expected secessions would be postponed, somewhat to the benefit of the Society. I doubt, however, whether this error would be important except in the case of recent entrants, at advanced ages, contributing by a graduated scale. These exceptions would moreover be a small proportion, as in the great majority of societies the admissions at the younger ages preponderate, despite the facilities offered for entrance up to middle life. I find that in my Group III, embracing the manufacturing districts, which probably show the highest average age at admission, rather more than one-half of the members enrolled in the five years, namely, 3,394 of a total of 6,769, were taken at ages under 22, whilst over 5,000 were under 25. In Group I (non-manufacturing) the admissions at ages under 22 numbered 4,030 of a total of

6,406 (as many as 1,403 being taken at age 18), whilst the number under 25 was in this class also close upon 5,000.

My conviction that some compression of the working tables involving the secession element is necessary is strengthened by the consideration that secessions, as well as sickness and mortality, must be analyzed in some degree with respect to locality and occupations. I have long had the impression that secessions were less frequent on the whole in the country than in the towns, and that even in different parts of the kingdom differing rates of withdrawal prevailed. To test this view I have analyzed the experience of the three groups of Lodges previously referred to, and have dealt separately with the "rural" and "urban" sections of each group. The results are shown in Table 36, and show that in the Urban Lodges of each group the rates of secession up to about 55 years of age, were from 50 to 100 per-cent above those of the Rural Lodges. Why this should be so I am unable to suggest, unless it be that with lower wages and fewer distractions the average rural dweller sets greater store by his friendly society than the average inhabitant of the towns. I do not consider that the difference between the average ages at admission in the two sections would account for more than a fraction of the differences between the two sets of rates. It will be seen from Table 37 that the same feature is revealed by Mr. Sutton's tables, the difference between the rates of Group 1 (populations under 2,000) and Group 5 (populations over 100,000) for two selected entry ages, 18 and 25, being very marked.

It is still more difficult to suggest why the rates of secession in both Rural and Urban Lodges should be greater in Group III than in the corresponding sections of Groups I and II. It may be that this feature would disappear on taking a wider basis of facts, and on excluding the withdrawal experience of entrants during the period. On this latter point some investigation has been made but the results are quite inconclusive.

TABLE 36.

*Manchester Unity, 1893-97.—Secession Rates (per-cent), in Groups of 100 Lodges.*

Ages	GROUP I, NON-MANUFACTURING			GROUP II, TEXTILE			GROUP III, MANUFACTURING ( <i>ex</i> TEXTILE), MINING, AND METROPOLITAN			Ages
	Rural Lodges	Urban Lodges	All Lodges	Rural Lodges	Urban Lodges	All Lodges	Rural Lodges	Urban Lodges	All Lodges	
16-19	2.90	3.99	3.13	1.43	3.16	2.63	2.51	4.82	3.90	16-19
20-24	4.82	7.43	5.32	2.82	6.83	5.68	4.86	8.50	7.14	20-24
25-29	3.84	6.37	4.33	2.83	6.30	5.26	3.82	7.59	6.33	25-29
30-34	2.46	3.92	2.77	2.16	4.81	4.04	2.67	5.54	4.63	30-34
35-39	1.69	2.68	1.91	1.43	3.33	2.74	2.49	3.73	3.34	35-39
40-44	1.23	1.58	1.31	1.15	1.94	1.68	1.21	2.00	1.73	40-44
45-49	.94	.88	.92	.80	1.17	1.06	.79	1.03	.94	45-49
50-54	.51	.39	.49	.28	.87	.67	.69	.88	.81	50-54
55-59	.52	.57	.52	.15	.76	.57	.45	.27	.35	55-59
60-64	.21	.13	.20	.20	.69	.53	.24	.26	.25	60-64
65-69	.25	.00	.22	.18	.17	.17	.00	.33	.19	65-69
70-74	.40	.62	.42	.00	.41	.18	.24	.00	.10	70-74
75-79	.00	1.49	.10	.00	.21	.15	.38	.35	.36	75-79
80-84	.00	.00	.00	.00	.00	.00	.00	.91	.48	80-84

TABLE 37.

*Registered Friendly Societies Experience, 1876-80.—Secession Rates (per-cent) amongst Entrants at 18 and 25, Group 1 (Populations under 2,000) and Group 5 (Populations over 100,000).*

Duration <i>n</i>	ENTRY AGE 18		ENTRY AGE 25		Duration <i>n</i>
	Group 1	Group 5	Group 1	Group 5	
	$\Sigma E_n = 70,823$ $\Sigma w_n = 2,539$	$\Sigma E_n = 14,868$ $\Sigma w_n = 1,097$	$\Sigma E_n = 13,935$ $\Sigma w_n = 477$	$\Sigma E_n = 15,498$ $\Sigma w_n = 848$	
Secession Rates (per-cent) per annum—Unadjusted					
1	4.93	13.73	6.92	16.13	1
2	5.05	11.79	7.71	13.24	2
3	5.14	8.93	4.71	8.94	3
4	4.84	8.81	6.55	6.36	4
5	4.64	7.35	4.21	8.28	5
6	4.88	7.89	5.15	6.03	6
7	4.11	6.01	4.62	3.88	7
8	3.68	5.65	3.04	4.34	8
9	2.79	5.28	2.84	4.60	9
10-12	2.32	4.05	1.58	2.82	10-12
13-15	1.65	2.80	1.63	2.14	13-15
16-18	1.78	2.32	1.53	2.00	16-18
19-21	1.08	2.63	1.01	1.18	19-21
22-24	.92	1.65	.95	1.50	22-24
25-27	.78	1.73	.36	.79	25-27
28-30	.06	.00	.58	1.30	28-30

## CONCLUSION.

To sum up the results of the various experiments which have been made it may, I think, be concluded :—

- (1) That as regards *Mortality*, a distribution of the data by the population test, whilst yielding some result in varying death rates, is unsuitable for valuation purposes, as aggregating a mass of non-homogeneous experiences; that a distribution by localities in which to a great extent this unsatisfactory feature is avoided is practicable, especially if effected with a prior knowledge of the districts in which mortality is persistently above or below a common standard; that such a method will afford a wide and serviceable range of tables, and for this reason will be fully justified.
- (2) That as regards *Sickness*, the risks of rural districts promise on the whole to be something less than those of urban localities, and on this account a distinction may be profitably made between the two; that the separate examination of the risks of certain “hazardous” classes of occupation is necessary, such classes being somewhat numerous, and the claims of some of them being influenced, so far as can be judged, by considerations other than that of liability to accident or special forms of disease; that the element of “duration of sickness” presents its own problems, and that the methods by which these are solved will have a sensible bearing on the money values to be ultimately obtained.
- (3) That as regards *Secession* or *Lapse* a distinction should be made between the rural and urban classes; that the observed rates of lapse may be diminished and defensibly so, by excluding from the data the whole of the facts relating to members admitted within the period examined, and that some such approximate method of giving effect to this peculiar element is necessary if the standard tables are to be prepared on a comprehensive scale to show the concurrent operation of secession with the various rates of sickness and mortality which seem likely to be discovered.



I cannot presume to suppose that all the views I have expressed, or the conclusions at which I have arrived, will meet with universal acceptance, nor would I desire to escape the criticism which I have invited. But conscious that a subject which nearly touches the welfare of the people has always received the sympathetic consideration of the profession, I feel that no apology is needed for its re-introduction to our discussions. For the length to which, unexpectedly, my paper has extended I ask your kindly indulgence, and plead the absorbing interest that I have been led to take in the operations of the beneficent Institutions from the inner working of which my material has been derived.

TABLE 24.

*Valuation Balance Sheets of Representative Society.*

[Benefits: 10s. per Week for the 1st 26 Weeks of Sickness, 5s. per Week for the 2nd 26 Weeks, and 2s. 6d. per Week afterwards; £10 at Death. Contribution, 16s. per Annum.]

3 %

*Age of Society, 20 years.*

3 %

Valuation Basis	PRESENT VALUE OF						Reserve, or Net Liability	Valuation Basis
	Sickness Benefits			Death Benefit £10	Total Liabilities	Contribution of 16s. per Member per Annum		
	10s. per Week 1st 6 Months	5s. per Week 2nd 6 Months	2s. 6d. per Week after 12 Months					
	£	£	£	£	£	£	£	
1	37,303	4,785	15,463	10,963	68,514	48,794	19,720	1
2	48,522	5,915	17,275	10,963	82,675	48,794	33,881	2
3	38,156	4,625	12,402	12,369	67,552	44,921	22,631	3
4	42,732	4,663	12,345	12,369	72,109	44,921	27,188	4
5	44,422	4,903	13,892	12,369	75,586	44,921	30,665	5
6	65,626	7,419	20,571	12,369	105,985	44,921	61,064	6
7	39,717	4,996	14,129	11,986	70,828	45,920	24,908	7
8	44,196	4,994	14,073	11,986	75,249	45,920	29,329	8
9	45,943	5,239	15,796	11,986	78,964	45,920	33,044	9
10	67,615	7,878	22,624	11,986	110,103	45,920	64,183	10
11	40,058	4,408	7,348	12,247	64,061	45,310	18,751	11

TABLE 25.

*Valuation Balance Sheets of Representative Society.*

[Benefits: 10s. per Week for the 1st 26 Weeks of Sickness, 5s. per Week for the 2nd 26 Weeks, and 2s. 6d. per Week afterwards; £10 at Death. Contribution, 16s. per Annum.]

3 %.

*Age of Society, 40 years.*

3 %.

Valuation Basis	PRESENT VALUE OF						Reserve, or Net Liability	Valuation Basis
	Sickness Benefits			Death Benefit £10	Total Liabilities	Contri- bution of 16s. per Member per Annum		
	10s. per Week 1st 6 Months	5s. per Week 2nd 6 Months	2s. 6d. per Week after 12 Months					
	£	£	£	£	£	£	£	
1	37,730	5,539	19,389	12,479	75,137	43,334	31,803	1
2	48,772	6,756	23,487	12,479	91,494	43,334	48,160	2
3	38,867	5,450	15,642	13,921	73,880	39,354	34,526	3
4	42,515	5,289	15,605	13,921	77,330	39,354	37,976	4
5	43,824	5,542	17,534	13,921	80,821	39,354	41,467	5
6	63,434	8,291	24,713	13,921	110,359	39,354	71,005	6
7	40,657	5,909	17,897	13,534	77,997	40,397	37,600	7
8	44,151	5,695	17,859	13,534	81,239	40,397	40,842	8
9	45,525	5,953	20,012	13,534	85,024	40,397	44,627	9
10	65,594	8,842	27,316	13,534	115,286	40,397	74,889	10
11	41,590	5,324	9,432	13,645	69,991	40,211	29,780	11

TABLE 26.

*Valuation Balance Sheets of Representative Society.*

[Benefits: 10s. per Week for the 1st 26 Weeks of Sickness, 5s. per Week for the 2nd 26 Weeks, and 2s. 6d. per Week afterwards; £10 at Death. Contribution, 16s. per Annum.]

3 %.

*Age of Society, 70 years.*

3 %.

Valuation Basis	PRESENT VALUE OF						Reserve, or Net Liability	Valuation Basis
	Sickness Benefits			Death Benefit £10	Total Liabilities	Contribution of 16s. per Member per Annum		
	10s. per Week 1st 6 Months	5s. per Week 2nd 6 Months	2s. 6d. per Week after 12 Months					
	£	£	£	£	£	£	£	
1	38,397	6,042	23,149	13,935	81,523	41,859	39,664	1
2	49,309	7,388	27,927	13,935	98,559	41,859	56,700	2
3	39,863	6,078	18,784	15,446	80,171	37,719	42,452	3
4	42,852	5,793	18,751	15,446	82,842	37,719	45,123	4
5	44,140	6,037	21,021	15,446	86,644	37,719	48,925	5
6	62,985	8,921	28,145	15,446	115,497	37,719	77,778	6
7	41,797	6,599	21,555	15,015	84,966	38,849	46,117	7
8	44,581	6,247	21,522	15,015	87,365	38,849	48,516	8
9	45,961	6,501	24,057	15,015	91,534	38,849	52,685	9
10	65,260	9,537	31,271	15,015	121,083	38,849	82,234	10
11	43,065	6,064	11,391	15,051	75,571	38,710	36,861	11

*Approximate Adjustments of Standard-Values (based on Manchester Unity Experience 1866-70) to give the true Net Liability in certain cases of Deviation from the Standard Experience.*

[Benefits assumed: 10s. per Week in first 6 Months of Sickness, 5s. per Week in second 6 Months, and 2s. 6d. per Week afterwards.]

Actual Experience as per Valuation Books	AGE OF SOCIETY 20 YEARS				AGE OF SOCIETY 40 YEARS				AGE OF SOCIETY 70 YEARS			
	Combined Adjustments on Standard to Approximate to true Net Liability				Combined Adjustments on Standard to Approximate to true Net Liability				Combined Adjustments on Standard to Approximate to true Net Liability			
	True Net Liability Standard	Interest to be taken below permanently expected Rate	Sickness Values to be increased by	True Net Liability Standard	Interest to be taken below permanently expected Rate	Sickness Values to be increased by	True Net Liability Standard	Interest to be taken below permanently expected Rate	True Net Liability Standard	Interest to be taken below permanently expected Rate	Sickness Values to be increased by	Actual Experience as per Valuation Books
1	£ 1,652	1 per-cent	Nil	£ 1,008	1 per-cent	Nil	£ 1,076	1 per-cent	£ 1,076	1 per-cent	Nil	1
2	1,807	1 per-cent 1 per-cent	10 per-cent at all rates 100 per-cent on "after 12 months" period	1,616	1 per-cent	100 per-cent on "after 12 months" period	1,538	1 per-cent 1 per-cent	1,538	1 per-cent 1 per-cent	20 per-cent at all rates 100 per-cent on "after 12 months" period	2
3	1,207	1 per-cent	Nil	1,160	1 per-cent	10 per-cent at all rates	1,152	1 per-cent	1,152	1 per-cent	10 per-cent at all rates	3
4	1,450	1 per-cent	Nil	1,275	1 per-cent	Nil	1,225	1 per-cent	1,225	1 per-cent	Nil	4
5	1,636	1 per-cent	10 per-cent at all rates	1,392	1 per-cent	20 per-cent at all rates 100 per-cent on "after 12 months" period	1,327	1 per-cent	1,327	1 per-cent	20 per-cent at all rates 100 per-cent on "after 12 months" period	5
6	3,256	(Mining)	..	2,384	(Mining)	..	2,110	(Mining)	2,110	(Mining)	..	6
7	1,328	1 per-cent	Nil	1,263	1 per-cent	10 per-cent at all rates	1,251	1 per-cent	1,251	1 per-cent	10 per-cent at all rates	7
8	1,564	Nil 1 per-cent	20 per-cent at all rates 10 per-cent at all rates	1,371	1 per-cent	20 per-cent at all rates 10 per-cent at all rates	1,316	Nil	1,316	Nil	20 per-cent at all rates 100 per-cent on "after 12 months" period	8
9	1,760	1 per-cent	20 per-cent at all rates	1,408	1 per-cent	20 per-cent at all rates	1,430	1 per-cent	1,430	1 per-cent	20 per-cent at all rates	9
10	3,423	(Mining)	..	2,514	(Mining)	..	2,231	(Mining)	2,231	(Mining)	..	10

TABLE 29.

*Approximate Adjustments of Standard-Values (based on Manchester Unity Experience 1866-70) to give the true Net Liability in certain cases of Deviation from the Standard Experience.*

Actual Experience as per Valuation Basis	AGE OF SOCIETY 20 YEARS				AGE OF SOCIETY 40 YEARS				AGE OF SOCIETY 70 YEARS			
	Combined Adjustments on Standard to Approximate to true Net Liability		True Net Liability per £1,000 Standard	Sickness Values to be increased by	Combined Adjustments on Standard to Approximate to true Net Liability		True Net Liability per £1,000 Standard	Sickness Values to be increased by	Combined Adjustments on Standard to Approximate to true Net Liability		True Net Liability per £1,000 Standard	Sickness Values to be increased by
	Interest to be taken below permanently expected Rate	10 per-cent at both rates			Interest to be taken below permanently expected Rate	10 per-cent at both rates			Interest to be taken below permanently expected Rate	10 per-cent at both rates		
1	1/4 per-cent	10 per-cent at both rates	£ 1,423	1/4 per-cent	£ 1,339	1/4 per-cent	£ 1,326	1/4 per-cent	10 per-cent at both rates	10 per-cent at both rates	£ 1,326	1/4 per-cent
2	1 per-cent 1/4 per-cent	20 per-cent at both rates 100 per-cent on "after 6 months" period	2,205	1 per-cent 1/4 per-cent	1,937	1 per-cent 1/4 per-cent	1,829	1 per-cent 1/4 per-cent	30 per-cent at both rates 100 per-cent on "after 6 months" period	30 per-cent at both rates 100 per-cent on "after 6 months" period	1,829	1 per-cent 1/4 per-cent
3	1/4 per-cent	10 per-cent at both rates	1,440	1/4 per-cent	1,333	1/4 per-cent	1,302	1/4 per-cent	10 per-cent at both rates	10 per-cent at both rates	1,302	1/4 per-cent
4	1/4 per-cent 1/4 per-cent	12 1/2 per-cent at both rates 7 1/2 per-cent at both rates	1,660	1/4 per-cent 1/4 per-cent	1,423	1/4 per-cent 1/4 per-cent	1,362	1/4 per-cent 1/4 per-cent	12 1/2 per-cent at both rates 10 per-cent at both rates	12 1/2 per-cent at both rates 10 per-cent at both rates	1,362	1/4 per-cent 1/4 per-cent
5	1 per-cent 1/2 per-cent	10 per-cent at both rates 20 per-cent at both rates	1,905	1 per-cent 1/2 per-cent	1,581	1 per-cent 1/2 per-cent	1,503	1 per-cent 1/2 per-cent	12 1/2 per-cent at both rates 20 per-cent at both rates	12 1/2 per-cent at both rates 20 per-cent at both rates	1,503	1 per-cent 1/2 per-cent
6	(Mining)	..	3,719	(Mining)	2,656	(Mining)	2,333	(Mining)	..	..	2,333	(Mining)
7	1/4 per-cent 1 per-cent	15 per-cent at both rates 5 per-cent at both rates	1,629	1/4 per-cent 1 per-cent	1,475	1/4 per-cent 1 per-cent	1,447	1/4 per-cent 1 per-cent	20 per-cent at both rates 7 1/2 per-cent at both rates	20 per-cent at both rates 10 per-cent at both rates	1,447	1/4 per-cent 1 per-cent
8	1/4 per-cent 1 per-cent	20 per-cent at both rates 10 per-cent at both rates	1,843	1/4 per-cent 1 per-cent	1,570	1/4 per-cent 1 per-cent	1,502	1/4 per-cent 1 per-cent	20 per-cent at both rates 10 per-cent at both rates	20 per-cent at both rates 15 per-cent at both rates	1,502	1/4 per-cent 1 per-cent
9	1/4 per-cent	20 per-cent at both rates	2,109	1/4 per-cent	1,74	1 per-cent	1,656	1 per-cent	20 per-cent at both rates	20 per-cent at both rates	1,656	1 per-cent
10	(Mining)	..	3,908	(Mining)	2,842	(Mining)	2,501	(Mining)	..	..	2,501	(Mining)

Benefits assumed: 10s. per Week for the first 6 Months of Sickness, and 5s. per Week afterwards. £10 at Death. Contributions, 18s. per Member per Annum.

*also,* [ *approximately,* 10s. per Week for the first 12 Months of Sickness, and 5s. per Week afterwards. £10 at Death. Contributions, 19s. 6d. per Member per Annum. ]

[ Benefits assumed: 10s. per Week for the first 6 Months of Sickness, and 5s. per Week afterwards. £10 at Death. Contributions, 18s. per Member per Annum. ] also, [ 10s. per Week for the first 12 Months of Sickness, and 5s. per Week afterwards. £10 at Death. Contributions, 19s. 6d. per Member per Annum. ]



## DISCUSSION.

The CHAIRMAN (Mr. G. H. Ryan) said that anyone who had tried to grasp the mass of work which Mr. Watson had put before them would immediately feel that he had attempted a most exhaustive examination of his subject; had tried to wrest from the facts their inner significance, and to glean results from past records which were not yielded to the casual or careless observer. As this was a preliminary paper, it might be hoped that in the future they would owe to the author a scheme of monetary tables which would be as indispensable to the valuer of friendly societies as the unambitious but most useful work of his predecessor, Mr. Ratcliffe, had been in times gone by. It was curious that their *Journal* did not contain very many references to the great subject of friendly society valuations. There were but three papers of importance, including the classic paper of Mr. G. F. Hardy, and a paper by Mr. R. P. Hardy, dealing with the Hearts of Oak experience. On the other hand, what he would term the private literature of the subject contained a heap of most valuable information. He thought the great storehouse of information, in other words, the best text book, on the subject, would be found in the private reports of Mr. R. P. Hardy, who was present that evening. He (Mr. Hardy) had brought scientific methods to bear upon that most difficult and elusive problem, and he hoped that the Institute library would shortly possess a complete series of those reports for the use of future students, if it did not possess them already. Now, the main object of the present paper was to submit some classification of the data of friendly society statistics which would escape the objections to which Ratcliffe's method of classification was open. They had submitted to them a new grouping consisting of geographical and trade classifications, which subsequently were sub-divided into rural and urban divisions. Thus they had an elaborate scheme consisting of many separate collections of statistics derived from the experience of the Manchester Unity Order. He maintained that it was not at all material whether any one of those tables strictly represented the experience to which it related. What was important was that they now had provided for them several different bases for estimating the valuation of friendly societies' liabilities, and that, in the varied conditions of such societies throughout the country, one or other of those new instruments would be of use under circumstances where at present they were forced to utilize rough adjustments. The problem of friendly society valuations was a very difficult one, and nobody knew that better than Mr. Hardy. It was so, he supposed, because sickness results did not solely depend or almost entirely depend upon the law of nature, but the human will entered into them. To instance only one point in which the human will was very largely concerned, there was what was called "malingering" on funds. There were also other respects in which the exercise of the individual will of the assured member entered into and influenced the results presented by a friendly society. It therefore became extremely necessary that in choosing the basis for valuation of such societies, care should be taken to see that the experience of that society



conformed to the standard they proposed to adopt. He hoped in the course of the discussion something would be said on a feature often met with in rural and country districts, namely, the extremely heavy superannuation rate, or rate of sickness in superannuation periods. One could not understand why there should sometimes be in one society a rate of superannuation pay twice as heavy and twice as high as that in other societies, apparently similarly constituted. He was not sure that it was all a question of supervision. It seemed to him that the amount of the pay itself had something to do with the result, and also whether in superannuation members were allowed to do any work or not as a condition of continuing to draw the pay. That had a most vital influence upon the total amount of final sick pay experience. It was said in most enterprises that success bred success. In friendly societies he doubted whether that was a fact. He thought the successful society brought upon itself higher claims than the unsuccessful society. When a society boasted of being in a condition of great prosperity, the tendency among its members was to claim more sick pay than might otherwise be the case. A second point to which he hoped some remarks would be directed was the question of secessions. On that point there was a great deal to be said. It was an element which could scarcely be measured in the case of many societies, particularly small and country societies, where the local conditions were apt to lead to violent fluctuations in the rate of secession, and the financial condition of the society itself was apt to lead to such sudden changes that no standard became safe in the measurement of that decrement. It would be unwise to rely upon any standard rate of secession in the case of small societies, without constantly checking the expected against the actual decrement from that source, and making sure that a large margin existed against contingencies.

Mr. F. SCHOOLING said that the paper dealt mainly with the distribution of data with reference to the question of locality, density of population, and occupation. He thought Mr. Watson was right in coming to the conclusion to treat questions of mortality and sickness on different lines. Mr. Watson, in a paragraph on the reliability of data, stated that the ages of admission had been in some cases accepted, and went on to say that because they were nearly always corroborated by the ages on the certificates of death, therefore they must be correct. He was afraid that the fact of corroboration of the age by the death certificate could not be looked upon as an infallible test. The ages at death were sometimes given by the relatives to agree with the age of admission—in fact, the age of admission formed the basis from which the age at death was arrived at. With regard to mortality, no doubt density of population was a great factor, but, as Mr. Watson had pointed out, it was not the only one. The author's division into three groups was very ingenious, and was an improvement on the old rural, town, and city groups. Mr. Watson's groups could be further sub-divided, of course; the difficulty was to know where to stop. If he had sub-divided his textile districts, and separated Yorkshire from Lancashire, Mr. Schooling thought that the former district would show considerably better mortality rates. The Registrar-General, in his

supplement to the Fifty-fifth Annual Report, in considering the mortality in various occupations, divided the occupied males between the ages of twenty-five and sixty-five in England and Wales into three groups, namely, London, industrial districts, and agricultural districts. Taking 1,000 as the standard measurement for all males, not only occupied males, the comparative mortality figures for the three districts mentioned were—London, 1,147; industrial districts, 1,248; agricultural districts, 687. Those figures very fairly corroborated the figures produced by Mr. Watson. Looking at Mr. Watson's figures in the aggregate, it would be seen that his investigations agreed with other recent investigations as to the mortality of the country; at the younger ages there was a marked improvement, but the mortality at the older ages did not exhibit that improvement, but rather the reverse. In dealing with sickness, Mr. Watson adopted a different classification, ultimately dividing the sickness experience into nine different groups. Of those the sickness experience amongst miners was much the worst. That exemplified the well-known fact that sickness rates did not follow death rates, for, according to the Registrar-General's returns, coal-miners were a very healthy lot. Again, taking 1,000 as the standard of measurement for all males, coal-miners as a whole appeared as 925, while if they were sub-divided into districts they had the Derby and Notts miners as only 727, the Northumberland miners running them very close with 774, the South Wales miners being the highest, 1,145. It appeared, therefore, that although fatal accidents were insufficient in number to make the mortality of miners other than a healthy occupation from the mortality standpoint, yet the number of non-fatal accidents rendered the occupation a very hazardous one from a sickness standpoint. It was rather surprising to find in Table 27 that the reserve required by any one of the nine divisions was greater than that required for the combined rural town and city districts of the Manchester Unity, in some cases the reserve required being more than double. Mr. Watson did not consider those large departures from the standard of much moment. He assumed that it was generally the custom to take a rate of interest well below that obtained. Three per-cent, Mr. Schooling believed, was generally assumed, and some friendly societies had a difficulty in obtaining that rate, so that in many cases there was not much to be hoped for from the interest margin. Other adjustments were suggested, and a table given, but he understood that Mr. Watson meant to let them have tables whereby accurate estimates of the liabilities could be made, and so render the very unsatisfactory method of using inaccurate tables with adjustments a thing of the past. With regard to secessions, if it were unfortunately necessary that the rate of secession must be taken into account, he could not help thinking that even a modification of the aggregate method, such as that suggested by Mr. Watson, must be looked at with extreme caution. The expedient was suggested to get over the great trouble which the use of select tables involved, but aggregate secession tables were so very full of pitfalls that no method should be adopted without making the very fullest investigations as to the rates of secession which obtained in the society under investigation. Although Mr. Watson

showed how marked were the differences of sickness experience in different occupations, he (Mr. Schooling) thought that the laxity or strictness with which the rules were enforced might be almost as great a factor as occupation.

Mr. C. H. E. REA said that Mr. Watson was one of the fortunate members of the Institute who were in possession of an immense amount of detail and facts appertaining to friendly societies, upon which he could speak with great authority. The importance of the subject was marked by the fact that so many distinguished members of the Institute had preceded Mr. Watson in investigating the past records, and compiling tables with a view to arriving at a proper standard of measure for estimating the sickness mortality to be expected in the numerous friendly societies. As to the reliability of data, the author was to be congratulated on the very useful device of applying cards with different colours to the three classes of members, (1) those dying (2) those withdrawing from observation, and (3) those existing on the 31 December 1897. There could be no doubt, considering the system of checking employed, that the facts brought out might be relied on implicitly as correctly representing the original data. He agreed, however, with the remarks of Mr. Schooling regarding the confidence which Mr. Watson placed in the members' statements of age. The general experience heretofore had shown that members of these societies, to a very considerable extent, understated their ages on proposals, and the certificates of death were no more reliable in that respect than the original declarations. Table I showed very concisely the different classifications which had been made from Mr. Neison's time down to Mr. Sutton's recent publications of Friendly Society Returns. In the next table, where Mr. Sutton's grouping of figures for males (1876-80) were compared with the Manchester Unity experience for 1866-70 (for city, town, and rural combined), it might be suggested that it would be a valuable addition to show a comparison of the mortality of the respective groups with all the groups combined, as distinct from the comparison with the Manchester Unity table. Table 4 seemed to confirm the experience set forth in earlier papers, and practically showed that locality had very little effect on the amount of sickness experienced. It was curious, as had been demonstrated in the past, that the susceptibility to attack bore an inverse ratio to the duration of sickness. The system introduced by Mr. Watson of classifying mortality and sickness on different bases was important; there certainly was little to show in this paper in support of the theory of relationship of sickness to mortality as age advanced. There was a very great deal to be said in favour of the new arrangement for classifying mortality statistics, and he agreed that on the basis of density of population alone, districts could not be satisfactorily grouped together as representing a probable like experience. The difficulty attending Mr. Watson's method was especially evident in this country, seeing the practical impossibility of getting a correct demarcation of those different centres on anything like the broad lines that were so essential in these societies' tradings. It had been shown in former contributions to the *Journal* that heavy labour in rural districts gave increase of vitality in nearly all cases. He thought a comparison of



respective groups in Table 6 with the whole taken together would be an interesting addition to the paper. The results of Table 10 showed that greater discrimination had been used in Mr. Watson's new groupings than appeared in either the case of the Manchester Unity or Mr. Sutton's table, but whether Mr. Watson was here approaching what he called the elements of finality he was not quite sure. It had been abundantly recognized that sickness was an extremely difficult subject to deal with on account of the impossibility of keeping it within exact limits of friendly society work. Members were sick in time of bad trade, or want of employment, and again, the particular rules of any given society would affect its sickness experience, and in fact there was no end of subtle influences, but the chief one, he thought, was dependent on supervision. Mr. G. F. Hardy had said that, "Whenever a group of persons or of societies is sufficiently homogeneous the principle of averages will be found to apply as much in respect of sickness as for deaths", and, were uniform supervision possible, no doubt they could make a distinct advance towards the establishment of a correct and reliable law for their purposes as to the effects of (1) light and heavy labour, (2) locality, and (3) density of population, on the amount of sickness. Mr. Watson's figures tended to confirm the experience of earlier writers on the subject and showed that the amount was not materially disturbed in any case. Later on in the paper there was given a classification of Welsh members in the Manchester Unity, according to different employments, and the result would seem to detract very much from what Mr. Sutton brought out in his experience as to hazardous risks in that locality, and on that account it must be regarded as an important statement. Table 15 was valuable as showing how in respect of the new grouping, the Manchester Unity Experience of 1866-70 failed as a table of sickness for the period 1891-5. With regard to Table 17, he would again venture to suggest that it would be an interesting addition to the paper if the author included a comparison of individual groups with the aggregate experience. In Table 27, there were some very striking results indeed, inasmuch as the miners' risk was there exhibited in a most pronounced and unmistakeable manner with regard to sickness experience. In his opinion, supervision had the most pronounced effect and entirely over-rode all other outside influences.

Mr. R. P. HARDY said that he wished to discharge a duty which, to him, was peculiarly agreeable, namely, to congratulate Mr. Watson upon his appearance on that occasion as the reader of a paper on a subject that was not only especially his own, but one upon which actuaries knew so little, and respecting which they ought to know so much. The subject was so considerable in its range that it would be impossible to enter upon any detailed discussion of the various points; it would, perhaps, be sufficient to say that he deliberately accepted the broad principles of the methods laid down. He had found, after study of the paper, that there were many things of which he was ignorant, and which, perhaps, he ought to have known. Mr. Watson had sketched the outlines of the solution of a problem which was far in advance of anything that had ever been done, or even attempted, and that sketch would serve them for some time to come. The problem

presented was complex, and its issues were of vast importance, and only those whose attention had been specially directed to the subject could appreciate the difficulties of arriving at a sound and practical basis. It was supposed that a sickness benefit was very unimportant. If the matter were looked at either in its mathematical incidence or in its practical outcome it would be found that it was far more onerous than life assurance, for whereas it was appointed unto men once to die, one could be sick every day of the week after entry. If they proposed to debit a society with the cost of an undue past experience, which better management might improve, they might be inflicting a serious and permanent injury upon the society, and check what might otherwise be a career of usefulness. If, on the other hand, they shut their eyes, and gave the go-by to certain unfavourable experiences that had presented themselves, they might be encouraging the members to persevere in a course which would certainly end in disappointment, and probably in absolute ruin. They had often been perplexed to know whether the final sentence of death ought to be passed, or whether an attempt should be made at reconstitution. So unsatisfactory did he find that state of things, and so seriously did the responsibility weigh upon him, that many years ago he abandoned dealing with the ordinary societies. Everyone must often have desired to have at hand some convenient summary of variations from the common standards that investigators had noted, some practical examination of their effects upon the customary reserves, and some suggestions as to treating such abnormal specialties. But they had hitherto looked in vain for such assistance. To-night they could say that a commencement towards a definite body of doctrine had been made—a commencement which not only started from the proper point, but proceeded along the proper road. Mr. Watson had a magnificent opportunity in life; his materials were abundant and of every shade of variety, so that he could condescend to details that would gladden the hearts of the Statistical Society. He would be able to view the aberrations that might be attributed to the paucity of members in a lodge; he could examine the alleged influence of climate, or the so-called effects of occupation; or, if he chose, he might toss all into the melting-pot, and produce what the platform speaker called a “broad average without any academic refinement”—which broad average in all probability would be erroneous. So far as he understood, Mr. Watson was not going to do that at all, nor was he going to be the tool of any faddists who would like to collect those results together for their own private purposes. Mr. Watson knew that in the necessary associations of mankind most of those differences of incidence, like all the other varieties of life, settled themselves by distribution over the whole body. But what he had worked for was, first, to find a general practical standard of measurement that could, in the language of Parliament, be “understood of the people.” There was no doubt that Mr. Watson’s actuarial training had given him a healthy scepticism of grouped results; he had learned to penetrate beneath the surface of mere statistical statements, and to dissect out the courses of possible disturbances—not with a view of ascertaining mere curiosities, but in order that he might provide some general, not necessarily universal, series of adjustments to be applied to standard



valuations. But notwithstanding their united efforts of work and criticism, led by Mr. Watson himself, all would be unavailing unless the members could be brought to recognize that the outcome of their contribution had limits, and that the premium for genuine human sickness did not provide an "out-of-work" benefit. Again, the entrance to the societies could be far better guarded than it was at present. The perfunctory examination that the members had to submit to was a perfect farce. Likewise, the supervision over the sickness, both social and medical, could be vastly improved. Those laxities of management, which were the survival of the old notion that these associations were fraternal and not business organizations, must be swept away, or else their tables were of no use at all.

The CHAIRMAN called upon Mr. Reuben Watson to say a few words,

Mr. REUBEN WATSON said he had heard nothing in the paper that he could controvert. He had heard much that he had been pleased with, and much that had already been approved; in fact, the author might, in preparing the paper, have been following what had been said from the chair, and by other speakers. No doubt he would give further consideration to the suggestions which had been made with regard to future tables. He (Mr. Watson) had had nothing to do with the paper further than being consulted from time to time, and watching its progress. He had been very pleased to hear the remarks which had been made, and he hoped that the paper would bear ripe fruit in the way of usefulness to millions of people connected with friendly societies, upon whom so much depended.

Mr. R. W. MOFFREY (Director M.U.) said that to no one would the paper be of more value than to the Manchester Unity, when the whole investigation was completed. But he would ask the Institute to remember the human element in friendly societies, and the effect of the human will on sickness. It might not be the province of the Institute of Actuaries to go into any but the most scientific calculations with regard to the data compiled by the Institute of Actuaries, and its effect on the bodies using it; but the members of friendly societies had to deal with institutes which were in existence, which were brought into existence not because of the Institute of Actuaries, but from that human feeling which led men to combine for mutual assistance. Friendly societies had to deal with human nature as they found it combined in the various institutions. The principle of friendly societies which bound them together was self-government, that every man had a perfect right, and, in fact, had the duty, to assist in the government of his society, but still there were some leaders who did all they possibly could to induce members of friendly societies to follow the teachings of the Institute of Actuaries, to whom friendly societies at the present day owed so much. But their power was limited. Friendly societies were established in most remote villages, and it was difficult to get the members of those societies even to read their own publications, and it was still more difficult to tell the members of those various lodges and branches of friendly societies what was absolutely necessary from an actuarial point of view, and to make them do what was absolutely necessary for their own salvation. Although he rejoiced that Mr. Watson had brought his mind to bear

upon the subject, and had produced such a valuable preliminary examination of the Manchester Unity experience, still he would ask the Institute of Actuaries to bear with friendly societies in the difficulties they had to encounter owing to that human element of which the chairman had spoken. They might depend upon it that, so far as those who endeavour to represent friendly societies were concerned, they would use their best efforts to bring the members up to the standard. But if they did not do it in this generation, he asked the Institute to have patience with them, being sure that they would try to profit by the teaching laid before them. All thoughtful members of friendly societies were devoting their most earnest efforts to induce the most laggard and backward branches to come up to that point, so that any member who joined their ranks might be assured of the benefits which he was promised on joining. That, he took it, was the aim of the Institute and of every other institution which sought the welfare of the working classes. He thought Mr. Hardy had hit the nail on the head when he said that there should be a more rigid examination of candidates. He was prepared to go the full length with Mr. Hardy, and remove, if it were possible, a great many of those who were now admitted members of the associations, but they could not tell those branches "You must not admit your next-door neighbour into your club." It was the old fraternal spirit which survived, and, in spite of the difficulties of the supervision of sickness, that was still a potent factor in the creed of friendly societies. Were it not for that fraternal spirit, wrong as it might be from the actuarial point of view, there would be many men left out of the ranks of friendly societies who now benefited by their inclusion in the ranks, and who were made self-dependent instead of reliant upon others when trouble came. It was not for him to urge upon the Institute all those facts, but to urge a consideration of the difficulties which present institutions laboured under from the errors inseparable from their formation—a formation dating probably years before the Institute of Actuaries came into existence, and consequently before it could devote thought to their well-being.

The CHAIRMAN, in asking Mr. Watson to reply, said that the profession was very much indebted to Mr. Watson for the great amount of time and attention he must have devoted to the preparation of his paper. He would not venture to repeat the eloquent terms in which Mr. Hardy had spoken of the strenuous and zealous work which Mr. Watson had put into his paper, but he hoped the discussion would sufficiently encourage him to proceed with the investigations to which his present paper formed so interesting an introduction.

Mr. ALFRED WATSON, in replying, thanked the members most sincerely for the generous support they had given to his paper. He thought that the publication by the Manchester Unity of a new set of tables would be something like an epoch, and it was a great support to know that the general lines upon which that investigation was proceeding had received the support of the Institute of Actuaries that evening. He might say for the officials of the society, for whom the actuaries of the Order and the staff were acting, that the support which the Institute had given to the method by which the work was

proceeding would thoroughly satisfy them that good work had been done. He had especially to thank Mr. R. P. Hardy, to whom he was greatly indebted, for the kindly remarks he had made. Mr. Schooling and Mr. Rea objected to his assumption that the corroboration of the entry ages by the ages given on the death certificate was sufficient proof that the entry ages were correct. He did not take that as absolute proof, especially as he had had a certain amount of that experience upon which he thought they were drawing when they stated that very often the entry age was the basis of the age given on the death certificate, and which, in passing, he might say, seemed to him to throw considerable doubt upon the compendious tables which were from time to time issued from the Registrar-General's office. But he would put forward this consideration, that membership of a friendly society was part of the working man's life; it was one of the things he took upon himself when he arrived at the period of manhood. He was introduced to the club, perhaps by his father, when his apprenticeship expired, or by his shopmates, or by some associates of his own age. There was no reason for concealment, and nothing in the way of keen competition for business to lead to an inducement being offered to understate the age. He thought he might claim for his friends, the Oddfellows, that although there were occasions when, for the sake of a penny or two in his monthly contribution, some member would understate his age by two or three years when he was admitted, those cases were very few and far between. When a certificate of death was applied for, for the purpose of claiming a death benefit from the type of friendly society to which the paper referred, in all probability the persons applying had not the least knowledge of the age the member had stated himself to be when he entered, perhaps 40, 50, or 60 years previously. Some criticism had been passed on his suggestion as to secession tables, and he thought a preference was expressed or implied for the select form of tables. He had only to say that if it were possible to involve the secession element in the select form with the complexities of sickness and mortality which seemed likely to present themselves, he would be only too glad to do it. But it must be remembered that since 1882, when the Act calling for quinquennial returns was abolished, friendly societies made no returns to Government, and nothing was now done for them with respect to publication of data. They had to do it for themselves, and investigation of that kind was an extremely costly matter. The Manchester Unity was looking forward to spending some £10,000 on its present investigations, and he thought that was in itself an evidence of public spirit on the part of that body. They ought not to put too great a strain upon the societies, and if they could find a practical plan which would cut down the cost to the benefit of the members, whilst cutting down the work so that they could view its outcome more clearly and more satisfactorily, he thought they were entitled to take advantage of that approximation. It had been questioned whether it was wise under any circumstances to bring in secession. For his own part he should be glad to leave that element out of consideration; and, indeed, up to the present, with valuations of the Manchester Unity Table of 1866-70, or the later Foresters' Table, it had not been necessary to consider the



secession element at all. But, as they all knew, Sutton's Tables showed a heavy increase in the sickness claims. He had, also, shown that the same thing prevailed in the Manchester Unity. If a number of friendly societies were to be called upon to pay largely increased contributions he was afraid that, much as they disliked it, they would have to take account of the counter-balancing element of secession, and see what that produced against the excess of sickness cost which they found they had now to recognize. He thanked the members for the patience with which they had listened to him. He had endeavoured to make a difficult subject agreeable. He also thanked them sincerely for the support they had given him in the method of pursuing an investigation which promised to be at least of some importance.

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## CORRESPONDENCE.

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### ON THE GROUPING OF ENDOWMENT ASSURANCES FOR VALUATION.

*To the Editor of the Journal of the Institute of Actuaries.*

SEHR GEEHRTER HERR,—Sie hatten die Güte, mir im Juli 1898 Gastfreundschaft zu gewähren, indem Sie meinen Brief über die Gruppenrechnung der Prämien-Reserven für gemischte Versicherungen in Ihrem *Journal* (vol. xxxiv, page 150 u. ff.) veröffentlichten.

Ein kürzlich empfangener Brief des Herrn Prof. Dr. Johannes Karup in Gotha veranlasst mich um Publizirung nachstehender Zeilen zu bitten.

Es war mir damals, als ich jenen Brief schrieb wohlbekannt, dass die darin mitgetheilte Methode für die deutschen, oesterreichischen und ungarischen Fachkreise nicht neu sei, wer sie aber zum erstenmale erfunden hat, konnte ich nicht eruiren, darum beschränkte ich mich darauf, zu sagen, dass sie bei uns angewendet wird. Herr Prof. Dr. Karup theilt mir nun mit, dass diese Methode bei der Lebensversicherungs-Bank für Deutschland in Gotha über seinen Vorschlag bereits seit dem Jahre 1878 angewendet wird, und dass die Bank diese Methode der österreichischen Regierung im Jahre 1882, der schweizerischen Regierung aber im Jahre 1884 mitgetheilt hat.

Die Priorität der Erfindung dürfte somit Herrn Prof. Dr. Karup gebühren, so dass es recht und billig wäre, der Methode den Namen Karup's beizulegen, als desjenigen, der sie zum erstenmale erfunden hat. Denn erfunden wurde die Methode von Vielen ganz unabhängig von einander. Zum Beweise dessen, dass sie sich fast von selbst aufdrängt, wenn man sich der geisttödtenden Arbeit der Einzelnberechnung der Reserven für gemischte Versicherungen entziehen will, sei es mir gestattet, mitzutheilen, wie ich sie seinerzeit erfunden habe.

Als nächstliegende Methode zur Gruppierung der gemischten Versicherungen für die Reserveberechnung bot sich die doppelte Gruppierung nach Fälligkeits-Jahren und innerhalb dieser nach

Geburts-Jahren, so dass die Factoren  $A_{x+\kappa; \overline{n-\kappa}|}$  und  $a_{x+\kappa; \overline{n-\kappa}|}$  für alle Versicherungen einer kleinen Gruppe identisch sind.

Da nun

$$A_{x+\kappa; \overline{n-\kappa}|} = \frac{M_{x+\kappa} - M_{x+n} + D_{x+n}}{D_{x+\kappa}} = A_{x+\kappa} - \frac{dN_{x+n}}{D_{x+\kappa}}$$

und  $a_{x+\kappa; \overline{n-\kappa}|} = \frac{N_{x+\kappa} - N_{x+n}}{D_{x+\kappa}} = a_{x+\kappa} - \frac{N_{x+n}}{D_{x+\kappa}}$

ist man ohneweiters veranlasst, sämtliche Untergruppen, für welche  $x+\kappa$  dieselbe Zahl ist, zusammenzufassen, weil  $N_{x+n}$  für eine jede einzelne Versicherung constant ist.

Die Technik der Gruppenrechnung ist in der oesterr.-ungarischen Monarchie und im deutschen Reiche sehr ausgebildet, weil man hier auf die ziffermässige Genauigkeit der Resultate seit jeher grosses Gewicht legte, und ich glaube, dass es keine, noch so complizirte Versicherungs-Combination auf ein Leben gibt, für welche ein jeder, auch nur halbwegs gebildete Versicherungs-Techniker nicht mit Leichtigkeit eine Gruppen-Rechnungs-Methode zum Zwecke der Bestimmung der Prämien-Reserven ersinnen würde. So z. B. sind die Methoden für die Gruppen-Rechnung der Reserven für die Versicherungen auf bestimmten Termin (*Assurances à Terme Fixe*)\*

( $P' = \frac{v^n}{a_{x:n}}$ ) und für die Erlebens-Versicherungen (*Endowments*)

mit Prämien-Rückgewähr  $\left\{ P' = \frac{P_{x:n}^1}{1 - P(IA)_{x:n}^1} \right\}$  allgemein bekannt.

Da diese Formeln eventuell von Interesse sein könnten, sei es mir gestattet, dieselben hier mitzutheilen.

*Versicherungen auf bestimmten Termin.*—Wenn  $V'$  die Reserve nach  $\kappa$  Jahren und  $P'$  die jährliche Prämie bedeutet, dann ist

$$V' = v^{n-\kappa} - P' a_{x+\kappa; \overline{n-\kappa}|} = \frac{v^{x+n}}{v^{x+\kappa}} - P' a_{x+\kappa} + \frac{P' N_{x+n}}{D_{x+\kappa}}.$$

*Erlebens-Versicherungen mit Prämien Rückgewähr.*—Wenn, wie vorhin,  $V'$  die Reserve nach  $\kappa$  Jahren und  $P'$  die Prämie bedeutet, so ist

$$\begin{aligned} V' &= P' \frac{N_x - N_{x+\kappa}}{D_{x+\kappa}} - P' \frac{R_x - R_{x+\kappa} - \kappa M_{x+\kappa}}{D_{x+\kappa}} \\ &= P' \frac{(N_x - R_x)}{D_{x+\kappa}} + P' \left\{ \frac{(x+\kappa) M_{x+\kappa} + R_{x+\kappa}}{D_{x+\kappa}} \right\} - x P' A_{x+\kappa} - P' a_{x+\kappa}. \end{aligned}$$

Für den Fall, dass die Brutto-Prämie (*office premium*) rückzuerstatten ist, wird die Formel lauten:

\* Das sind Versicherungen zahlbar an einem bestimmten Verfallstage ohne Rücksicht auf das Leben des Versicherten; die Prämienzahlung hört jedoch auf, wenn der Versicherte vor dem Termine stirbt.



$$V' = \frac{PN_x - P'R_x}{D_{x+\kappa}} + P' \frac{R_{x+\kappa} + (x+\kappa)M_{x+\kappa}}{D_{x+\kappa}} - xP'A_{x+\kappa} - Pa_{x+\kappa},$$

wo P die Netto- und P' die Brutto-Prämie bedeutet.

Wie man auch bei diesen Ableitungen sieht, kommt es immer nur auf einen geschickten Griff an, um die Reserve-Formeln für die Gruppen-Rechnung brauchbar zu machen. Den Griff, für  $v^{n-\kappa}$ ,  $\frac{v^{x+n}}{v^{x+\kappa}}$

zu schreiben, um eine constante ( $v^{x+n}$ ) und eine nur vom gegenwärtigen Alter ( $x+\kappa$ ) abhängige Zahl zu haben, hat z. B. auch Herr Louis Maingie\* und zwar ganz unabhängig davon gefunden, dass er schon früher bekannt war.

Für die gütige Veröffentlichung dieser Zeilen bestens dankend, zeichne ich

Hochachtungsvoll

als Ihr ergebener

JULIUS ALTENBURGER.

Triest, den 19 Januar 1900.

#### TRANSLATION.

HONOURED SIR,—In July 1898 you were good enough to afford me the hospitality of your *Journal* by publishing my letter "On the grouping of Endowment Assurances for Valuation" (*J.I.A.*, xxxiv, 150).

A letter which I have lately received from Professor Dr. Johannes Karup, of Gotha, induces me to ask you kindly to give insertion to the following lines.

When I wrote my former letter, I was well aware that the method therein set forth was not a new one as far as German, Austrian, and Hungarian actuaries were concerned; but I could not remember who had first discovered it. I therefore confined myself to stating that it was made use of among us. Dr. Karup now informs me that the method has been employed, at his suggestion, by the Gotha Life Assurance Company ever since 1878. He further states that the Gotha Office communicated it to the Austrian Government in 1882, and to that of Switzerland in 1884.

The honour of the first discovery seems, therefore, to belong to Dr. Karup, and it would be only right to call the method by his name, as that of its first discoverer. As a matter of fact, however, the method has been discovered quite independently by many persons. In reality, it is almost forced upon us if we desire to avoid the overwhelming labour involved in the calculation, case by case, of the

\* "Sur quelques Méthodes de grouper les Assurances en vue du calcul des Reserves." Par Louis Maingie.—*Bulletin de l'Association des Actuaires Belges*, No. 7, 15 Décembre 1899.

Reserves for Endowment Assurances, and I may, perhaps, be permitted to explain how I discovered it in my turn.

The most obvious method for collecting Endowment Assurances, with a view to valuation, is that involving a twofold grouping—first, according to the year of maturity; and secondly, the arrangement of each of such groups according to the year of birth—so that the factors  $A_{x+\kappa; \overline{n-\kappa}|}$  and  $a_{x+\kappa; \overline{n-\kappa}|}$  are identical for all the assurances in a sub-group.

Now since

$$A_{x+\kappa; \overline{n-\kappa}|} = \frac{M_{x+\kappa} - M_{x+n} + D_{x+n}}{D_{x+\kappa}} = A_{x+\kappa} - \frac{d\mathbb{N}_{x+n}}{D_{x+\kappa}}$$

$$\text{and } a_{x+\kappa; \overline{n-\kappa}|} = \frac{\mathbb{N}_{x+\kappa} - \mathbb{N}_{x+n}}{D_{x+\kappa}} = a_{x+\kappa} - \frac{\mathbb{N}_{x+n}}{D_{x+\kappa}}$$

the possibility suggested itself of collecting together all the sub-groups in which  $x+\kappa$  was the same, since  $\mathbb{N}_{x+n}$  is constant for each individual assurance.

The art of the calculation of values in groups is very highly developed in Austria-Hungary and in Germany, because in these countries great importance has always been attached to the arithmetical accuracy of results; and I believe that there is no combination of assurances on one life, however complex, for which any actuary, even if little more than a beginner, could not easily devise a method of calculation by groups for the purpose of determining the necessary reserves.

For instance, for calculating by groups the reserves for Fixed Term Assurances (Assurances à Terme Fixe)\*,  $\left(P' = \frac{v^n}{a_{x\overline{n}|}}\right)$  and for

Endowments with Return of Premium,  $\left\{P' = \frac{P_{x\overline{n}|}^1}{1 - P(1A)_{x\overline{n}|}^1}\right\}$ ,

formulas are universally known. As these formulas may prove of interest, I take leave to communicate them here.

*Fixed Term Assurances.*—If  $V'$  be the reserve after  $\kappa$  years, and  $P'$  the annual premium, then

$$V' = v^{n-\kappa} - P' a_{x+\kappa; \overline{n-\kappa}|} = \frac{v^{x+n}}{v^{x+\kappa}} - P' a_{x+\kappa} + \frac{P' \mathbb{N}_{x+n}}{D_{x+\kappa}}.$$

*Endowments with Return of Premium.*—If, as before,  $V'$  be the reserve after  $\kappa$  years, and  $P'$  the premium, then

$$\begin{aligned} V' &= P' \frac{\mathbb{N}_x - \mathbb{N}_{x+\kappa}}{D_{x+\kappa}} - P' \frac{R_x - R_{x+\kappa} - \kappa M_{x+\kappa}}{D_{x+\kappa}} \\ &= P' \frac{(\mathbb{N}_x - R_x)}{D_{x+\kappa}} + P' \left\{ \frac{(x+\kappa) M_{x+\kappa} + R_{x+\kappa}}{D_{x+\kappa}} \right\} - x P' A_{x+\kappa} - P' a_{x+\kappa}. \end{aligned}$$

\* These are assurances payable at the end of a fixed term without reference to life; the premiums, however, ceasing should the assured die within the term.

In cases where the gross (office) premium is to be returned, the formula would be as follows:

$$V' = \frac{PN_x - P'R_x}{D_{x+\kappa}} + P' \frac{R_{x+\kappa} + (x+\kappa)M_{x+\kappa}}{D_{x+\kappa}} - xP'A_{x+\kappa} - Pa_{x+\kappa},$$

where  $P$  is the net and  $P'$  is the office premium.

It is apparent from these examples that a simple artifice is all that is necessary in order to make the Reserve Formulas applicable for the purpose of valuation by groups. For example,

M. Louis Maingie has also conceived the idea of writing  $\frac{v^{x+n}}{v^{x+\kappa}}$  instead of  $v^{n-\kappa}$ , in order to have one constant,  $v^{x+n}$ , and a number dependent only on the age attained,  $x+\kappa$ , and this quite independently, and without being aware of its having already been discovered.

Thanking you in advance for your courtesy in inserting this communication, I beg leave to subscribe myself, with great respect,

Yours faithfully,

JULIUS ALTENBURGER.

[The method of valuation referred to by Herr Altenburger is evidently applicable to any single-life benefit determinable at the expiration of a fixed period. The value of any such benefit, if expressed in commutation symbols, will involve functions of  $x+\kappa$ , the valuation age, and functions of  $x+n$ , the age at the expiration of the fixed term. Since  $x+n$  does not vary during the whole currency of the contract, the latter functions may be calculated for each policy at the outset, and treated as part of the valuation data, and thus the only variable functions will be functions of  $x+\kappa$  alone; and hence all benefits of the same form on lives aged  $x+\kappa$ , whatever may be the unexpired term, may be grouped with similar whole-life contracts.

It may be pointed out, however, that the method loses much of its advantage when applied to With-Profit Policies, since any change in the Bonus Additions, or in the Reductions of Premium, will necessitate the recalculation of the functions of  $x+n$ . Moreover, the formulas will in many cases become too complex to be of practical use.

ED. J.I.A.]

## THE LIFE ASSURANCE COMPANIES OF THE UNITED KINGDOM.

*Summary of the Life Assurance and Annuity Revenue Accounts.*

[Extracted from the Parliamentary Return for 1899, published in 1900.]

INCOME	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£
Balance at the beginning of the Year . . . . .	224,372,455	16,969,333	241,341,788
Adjustments: for capital removed from life account in the case of two companies now transacting other business (—£1,024,398) and —£1,052,057, for one Return discontinued (—£10,183); and for two transferred from ordinary to industrial class (—£28,254 and —£2,147) . . . . .	—2,117,039	+ 30,401	—2,086,638
	222,255,416	16,999,734	239,255,150
Premiums . . . . .	20,829,017	8,078,728	28,907,745
Consideration for Annuities . . . . .	2,356,812	11,534	2,368,346
Interest and Dividends (less Tax)	8,390,852	563,530	8,954,382
Increase in value of Investments . . . . .	416,552	5,085	421,637
Fines, Fees, &c. . . . .	13,725	992	14,717
Capital Paid-up . . . . .	34,839	52,143	86,982
Customs Timber Measuring, &c. . . . .	3,354	...	3,354
Transfers from other Accounts . . . . .	21,043	81,843	102,886
Miscellaneous . . . . .	21,581	...	21,581
	254,343,191	25,793,589	280,136,780
OUTGO	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£
Claims . . . . .	15,597,349	3,131,916	18,729,265
Cash Bonuses and Reduction of Premiums . . . . .	1,081,438	559	1,081,997
Surrenders . . . . .	992,682	44,997	1,037,679
Annuities . . . . .	1,603,069	6,697	1,609,766
Commission . . . . .	1,167,111	2,091,480	3,258,591
Expenses of Management . . . . .	1,751,603	1,505,950	3,257,553
Bad Debts . . . . .	8,862	87	8,949
Decrease in value of Investments . . . . .	345,679	5,016	350,695
Interest on Capital and Dividends and Bonuses to Shareholders . . . . .	381,680	458,047	839,727
Transfers to other Accounts . . . . .	63,749	156,557	220,306
Miscellaneous . . . . .	10,384	...	10,384
Balance* at the end of the Year . . . . .	231,339,585	18,392,283	249,731,868
	254,343,191	25,793,589	280,136,780

\* This Balance includes the whole of the Life and Annuity Funds (£246,098,788), and, in addition, the Capital of Companies whose business is limited to Life Assurance only.

*Summary of the Balance Sheets (1899).*

LIABILITIES	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£
Paid-up Capital (including sundry Shareholders' Balances) . . .	11,430,781	1,513,998	12,944,779
Life and Annuity Funds . . .	228,874,161	17,224,627	246,098,788
Fire Funds of Companies trans- acting Life Business . . .	10,898,466	...	10,898,466
Marine Funds of Companies trans- acting Life Business . . .	644,885	...	644,885
Reserve Funds . . .	4,201,936	750,000	4,951,936
Other Funds . . .	1,268,858	199,100	1,467,958
Profit and Loss Balances . . .	4,504,725	...	4,504,725
Depreciation and Investment Ba- lances . . .	1,122,825	18,820	1,141,645
Globe Annuitants (Liverpool and London) . . .	1,102,800	...	1,102,800
Outstanding Claims . . .	4,300,218	41,966	4,342,184
Outstanding Accounts . . .	617,812	21,126	638,938
Temporary Loans . . .	46,728	6,039	52,767
	269,014,195	19,775,676	288,789,871
ASSETS	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£
Mortgages . . .	82,022,126	2,033,565	84,105,691
Loans on Policies . . .	11,881,691	38,029	11,919,720
„ Rates . . .	22,194,243	6,555,586	28,749,829
British Government Securities . .	4,827,716	1,823,764	6,651,480
Indian and Colonial Government Securities . . .	18,145,692	356,561	18,502,253
Foreign Government Securities . .	8,613,392	397,774	9,011,166
Debentures . . .	45,866,737	1,906,026	47,772,763
Shares and Stocks . . .	32,143,345	78,673	32,222,018
Companies' own Shares . . .	638,748	...	638,748
Land and House Property and Ground Rents . . .	20,329,664	5,159,711	25,489,375
Life Interests and Reversions . .	6,521,040	2,007	6,523,047
Loans on Personal Security . . .	1,582,065	7,359	1,589,424
Agents' Balances and Outstanding Premiums . . .	5,505,679	508,022	6,013,701
Outstanding Interest . . .	2,458,111	175,187	2,633,298
Cash, Deposits, Stamps, &c. . .	6,066,186	246,275	6,312,461
Customs Timber Measuring Ba- lances, &c. . .	3,014	...	3,014
Deficiencies, Preliminary Expenses, &c. . .	214,746	437,137	651,883
	269,014,195	19,775,676	288,789,871



INCREASE (+) or DECREASE (—) in the Chief Items of this Year's SUMMARY as compared with the corresponding Items for the previous Year.

	Ordinary Companies	Industrial Companies
INCOME.	£	£
Premiums . . . . .	+ 629,631	+ 508,578
Consideration for Annuities . . . . .	+ 370,920	+ 9,899
Interest and Dividends (less Tax) . . . . .	+ 192,322	+ 40,169
Net Result of Realization and Re-valuation of Investments . . . . .	— 102,248	+ 1,781
OUTGO.		
Claims . . . . .	+ 2,420,449	+ 219,870
Annuities . . . . .	+ 98,844	+ 1,555
Surrenders . . . . .	+ 62,343	+ 7,161
Commission . . . . .	+ 11,759	+ 139,081
Expenses of Management . . . . .	+ 7,458	+ 185,811
LIABILITIES.		
Paid-up Capital (including sundry Shareholders' Balances) . . . . .	+ 102,819	+ 62,183
Life and Annuity Funds . . . . .	+ 9,038,355	+ 1,377,899
ASSETS.		
Mortgages (including Loans on Rates) . . . . .	+ 583,607	+ 962,655
Life Interests and Reversions . . . . .	+ 587,856	— 12
Loans on Policies . . . . .	+ 574,941	— 1,627
British Government Securities . . . . .	+ 63,090	+ 181,122
Indian and Colonial Government Securities . . . . .	+ 306,661	+ 10,903
Foreign Government Securities . . . . .	+ 1,035,692	+ 57,930
Debentures . . . . .	+ 2,324,472	+ 108,323
Shares and Stocks . . . . .	+ 3,426,048	+ 3,546
Companies' own Shares . . . . .	— 3,144	...
Land and House Property and Ground Rents . . . . .	+ 1,501,091	+ 367,209
Loans on Personal Security . . . . .	— 6,488	+ 1,619

#### NUMBER OF COMPANIES.

The total number of Companies appearing in the above Summary is 95, of which 81 have been classed as Ordinary, 10 as Industrial, and 4 appear in both Classes, the Returns of these Companies showing the Ordinary and Industrial business separately. The Returns of the "British Homes", the "Life and Health", the "New Era", and the "Sickness, Accident, and Life", are included for the first time.

During the year three names have been removed from the official List of Companies, namely, "Law Property", and "Old Age Pension and Life Assurance", which are in liquidation; and the "Wool Industries Employers"; where the deposit was returned, the Memorandum of Association being altered to exclude Life Business. And one name has been added, namely, "United Provident Assurance Company, Limited"; in which case the Board of Trade have issued their warrant under the provisions of Section 1 of "The Life Assurance Companies Act, 1872."

SUMMARY OF THE ASSURANCES IN FORCE, *as shown by the last Returns of the Companies.*  
ORDINARY BUSINESS.

	WITH PROFITS		WITHOUT PROFITS		TOTAL		Re-assur- ances	Net
	No.	Amount	No.	Amount	No.	Amount	Amount	Amount
ASSURANCES.		£		£		£	£	£
Whole Term of Life	775,055	373,994,760	133,856	67,583,918	908,911	441,578,678	24,846,714	416,731,964
Limited number of Premiums . . .	41,644	24,983,692	8,269	3,420,968	49,913	28,404,660	1,348,793	27,055,867
Endowments . . .	816,699	398,978,452	142,125	71,004,886	958,824	469,983,338	26,195,507	443,787,831
Endowment Assur- ances . . .	1,929	407,506	14,763	3,778,867	16,692	4,186,373	10,500	4,175,873
Joint Lives . . .	704,247	118,468,766	45,181	14,333,867	749,428	132,802,633	1,907,154	130,895,479
Last Survivor . . .	15,851	3,300,475	2,569	1,105,386	18,420	4,405,861	392,369	4,013,492
Contingent . . .	944	761,087	1,123	1,411,962	2,067	2,173,049	362,652	1,810,397
Issue . . .	17	22,568	3,850	5,609,222	3,867	5,631,790	1,358,877	4,272,913
Miscellaneous . . .	4	13,500	1,213	4,590,751	1,217	4,604,251	1,326,493	3,277,758
	2,313	1,267,008	6,778	8,871,690	9,091	10,138,698	1,781,728	8,356,970
	1,542,004	523,219,362	217,602	110,706,631	1,759,606	633,925,993	33,335,280	600,590,713
ANNUITIES.								
Immediate . . .	...	...	...	...	26,054	1,510,028	41,429	1,468,599
Deferred . . .	...	...	...	...	10,905	291,638	15,173	276,465
	...	...	...	...	36,959	1,801,666	56,602	1,745,064

## INDUSTRIAL BUSINESS—(Sickness and Friendly Society Contracts not included).

	WITH PROFITS		WITHOUT PROFITS		TOTAL		Re-assur- ances	Net
	No.	Amount	No.	Amount	No.	Amount	Amount	Amount
ASSURANCES.						£	£	£
Whole Term of Life	...	...	...	...	16,388,447	157,743,192	1,000	157,742,192
Limited number of Premiums . . .	...	...	...	...	1,398	13,982	500	13,482
Endowments . . .	...	...	...	...	16,389,845	157,757,174	1,500	157,755,674
Endowment Assur- ances . . .	...	...	...	...	957,426	7,737,657	...	7,737,657
Joint Lives . . .	...	...	...	...	186,044	1,996,035	88	1,995,947
Contingent . . .	...	...	...	...	323,814	5,158,369	...	5,158,369
Miscellaneous . . .	...	...	...	...	4	1,910	400	1,510
	...	...	...	...	1	300	...	300
	...	...	...	...	17,857,134	172,651,445	1,988	172,649,457
ANNUITIES.								
Immediate . . .	...	...	...	...	63	3,185	...	3,185
Deferred . . .	...	...	...	...	2	123	...	123
	...	...	...	...	65	3,308	...	3,308

The above figures are based on Returns deposited, for the most part, during the last five years, and are, therefore, merely an approximation to the amount of contracts in force at the present time. In the case of two Companies, namely, the Customs Fund and the Northern, the amount of business at a more recent date has been included. The figures of the Colonial and Foreign Companies have been excluded, as their Returns do not separately show the extent of business in the United Kingdom.

# JOURNAL

OF THE

## INSTITUTE OF ACTUARIES.

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*Census Taking.* By REGINALD DUDFIELD, M.A., M.B., D.P.H.,  
*Medical Officer of Health of Paddington.*

[Read before the Institute, 30 April 1900.]

WHEN I accepted the suggestion of my friend, Mr. Woods, that I should open a discussion on this subject, I was in hopes that I should do so before the passage of the Bill for the Census of next year. As, however, that measure was added to the Statute Book at the end of last month, I have been compelled to approach my subject in a somewhat different manner. I shall, therefore, endeavour to set forth briefly my own views on the requisites of a successful Census and then examine the present Act to see how far the approaching Census promises to fulfil those conditions. That I shall have anything new to tell you, I do not for a moment expect, but I venture to hope that, as I regard the subject from a totally different standpoint to that which an actuary would adopt, I may be able to suggest points which will serve for an interesting, if not particularly useful discussion.

I do not know what objects the proposers of the first Census had in view, but, so far as I can see, Census taking without registration of, at least, death, has little value for public health work. It is true that a succession of Census will show the increase or decrease of the population during the intervening periods, and to a certain extent will indicate the algebraic sum of all those conditions which affect life and health. There would,

however, be nothing to indicate the factors themselves. With the introduction of registration of births and deaths we obtain an approximately accurate knowledge of the incidence of death from the various causes at the different ages, and we are able, by a comparison of local rates, to indicate localities where the conditions inimical to health prevail, and by further comparison and inference to ultimately ascertain exactly what those conditions are. Census taking and the registration of natality and mortality are mutually complementary for public health work; both are essential with a view to gauging the success or failure of those measures which are put forward for the amelioration of the conditions of life.

The questions which will first require consideration are: (1) what should be the character of the Census, *i.e.*, what information should be taken? and (2) how often should the Census be taken? I would here remark that I think a limited schedule is much to be preferred, if accuracy can be assured, than one which takes in all possible subjects of inquiry, but is, by reason of its complexity or other causes, inaccurate. I believe that the elaborate Census reports of certain countries which have been held up for imitation by us are not exempt from these failings.

At the International Congress of Statisticians held in St. Petersburg in 1872, the following minimum requirements were agreed to:—

- (a) that the Census should be nominal;
- (b) that it should be *de facto*;
- (c) that it should be decennial;
- (d) that it should be completed within twenty-four hours;
- (e) that the information to be obtained should include;
  - i, the name of the individual;
  - ii, his age;
  - iii, his sex;
  - iv, his relationship to the householder;
  - v, his civil status;
  - vi, his occupation;
  - vii, his religion;
  - viii, his language;
  - ix, his education;
  - x, his birth-place and nationality;
  - xi, his residence;
  - and xii, special mention of infirmities, such as blindness, deaf-mutism, cretinism, idiotcy, and insanity.

The Census was to be *de facto*, meaning that the persons were to be enumerated at the places where they were at the time, not at their proper residences, if away therefrom. Years ending in

cyphers were recommended for the taking of the Census, which was, if possible, to be taken at a definite hour of the day. The ages of the persons enumerated were to be recorded in years except in the case of infants under one year, whose ages were to be stated in months. We shall see later how far the schedules used by our Census Office follow out these recommendations.

This country is one of the few still adhering to the decennial period, but it is becoming every day more apparent that that interval is too long, and strenuous efforts were made both in 1890 and this year to secure the adoption of a shorter interval. From the discussion in the House of Commons, on the second reading of the present Act, I gathered that the Government was prepared to admit that the Census should be quinquennial, but declined to provide for an intermediate Census in the Act of this year, on the ground that it should be a matter of special legislation five years hence. It may be well to remind you that an intermediate enumeration has been enacted for the Metropolis for the purposes of the equalization of rates, and I may also mention that the Factories and Workshops Bill (Bill 111) of this Session contains, in clause 29, the germ of an occupational Census at much more frequent intervals.\*

It will hardly be necessary to give evidence in support of the need of more frequent Census Taking, but perhaps I may mention that the differences between the estimated populations of several of our large towns and the numbers ascertained, both in 1881 and 1891, were such as to seriously vitiate the statistics based on those estimates. The following figures, taken from a table recently published by Dr. Hope, Medical Officer of Health of Liverpool,† show the errors noted in certain of our great towns:—

At Census of 1881.		At Census of 1891.	
Nottingham	— 9,775 persons	Portsmouth	— 15,025 persons
Manchester	— 29,548 „	Newcastle	— 21,810 „
Salford ...	+ 15,504 „	Salford ...	+ 50,540 „
Sheffield ...	+ 26,280 „	Liverpool ...	+ 100,659 „
Bradford ...	+ 19,777 „		

The above figures indicate the amounts to which the estimated populations for 1881 (1891) were below (—) or above (+) the populations enumerated at the respective Census.

\* The clause which is to amend section 34 of the Factory Act of 1895 proposes to enact that returns of all persons employed in factories and workshops shall be made to the Chief Inspector of Factories at intervals of “not less than one nor more than three years.”

The Secretary of State is to be empowered to specify the particulars to be included in such returns.

† *Public Health*, xi, p. 36 (October 1899).



It would be foreign to my present subject, otherwise I should like to submit some observations on the method of estimating populations during the inter-censal periods. I have recently had occasion to calculate a series of estimates for upwards of forty years, and have been much dissatisfied with the traditional methods in use.

Were it possible to arrive at an ideal, I would suggest that the population ought to be enumerated annually, and a complete Census to be taken at (say) ten year intervals. In Holland, according to Professor Saltet,\* the system at present in vogue is such as to keep a very close account of the rate of change in the population. In addition to compulsory registration of births (within three days) and deaths (within five days), every person has to give notice to the police of a change of domicile, so that "the exact number of inhabitants at the end of each year is fairly well known."

I think we may conclude that there is a reasonable prospect of the inter-censal period being reduced to five years, and if that be so, it will be a matter for consideration as to what amount of information should be sought at the intermediate Census, *i.e.*, in 1906. It has not, I think, ever been suggested that such Census should be as full as the decennial, and personally I am inclined to think that it would suffice, at all events as a beginning, if the name, sex, and age of each individual were recorded for one unit of area only. With the establishment of a quinquennial Census, it is probable that the Census Office would be made permanent, with much advantage to the whole system. It would also be requisite that the returns of each Census should be issued more promptly than at present.

To those using the Census statistics of parts of the country only, the date at which a Census is taken may be a matter of importance. That adopted in this country occasionally comes too near Easter, a time when many persons are in the habit of going to holiday resorts. There is no doubt that in 1891 this fact had a considerable effect on the returns of such districts as South Paddington and South Kensington. With regard to the former district, a comparison of the totals for 1881 and 1891 indicated that the population had decreased at a rate of 364 per annum, while a similar comparison for 1891 and 1896 gave an annual decrease of 35 per annum. The only difference between the two Census takings appeared to be their relations to Easter.

\* *Transactions of Epidemiological Society*, xviii, p. 175.

It is, I fear, hopeless to expect that there will ever be a serious alteration in the date of decennial Census, but an effort should always be made to secure the taking of the Census as far from Easter as possible, and preferably before.

To the actuary in all probability the unit area of tabulation has but little interest. To us engaged in public health work it is a matter of considerable importance. It will be recognized at once that a large area will include groups of inhabitants of very varying social status, "housing", etc. To secure properly comparative statistics, it is requisite that the factors affecting the areas to be compared should be either nearly identical, or be sufficiently known to allow adequate corrections to be made. Hence it is desirable that the Census returns should be tabulated for the smallest possible areas of a fixed description. The London County Council has suggested that the returns should be given for each street, square, court, &c., and even for each side of the same. I should imagine that there is no chance of such elaborate statistics being prepared. Personally I have advocated during the past few months that the ward of each township or borough, should be made the basis of a separate tabulation, for the more important information contained in the schedule, such as sex, age, and "housing", subject to the proviso that the local authority should be entitled to obtain from the Registrar-General a reasonable amount of information relative to special areas of smaller size or presenting special features. Mr. BurrIDGE, in a communication to this Society,\* drew attention to the very large, I might say excessive, number of groups of areas for which the Census return was tabulated. I cannot help thinking that an attempt should be made to simplify the divisions of the country. I should like to see the whole country so mapped out that it should be possible to proceed from the smallest area (*e.g.*, the ward), through the district (urban or rural sanitary) to the county, and so on to the United Kingdom. The present divisions are largely the result of haphazard legislation, and some of them are, I think, obsolete.

On comparing the Act † of this year with those of 1880 and 1890, it will be found that many matters which were specifically legislated for on the earlier occasion, have on this been left for the Registrar-General to deal with by instructions. This appears

\* "Some Account of the Census from 1801 to 1881."—*Journal of the Institute of Actuaries*, xxv, p. 83.

† For the first time the Act applies to Scotland.

to me to be a distinct gain, as it will allow a considerable amount of elasticity as to rules and regulations, making it possible to frame the same to suit any special emergencies.

The date fixed by the Act, March 31st, although that recommended by, I think, all the Societies which had the matter under consideration, is as near to Easter in 1901 as was the day fixed in 1891. There is, therefore, a danger that the same underestimating of the populations of certain localities, and overestimating of others, which has already been alluded to, may again occur. It would be possible to arrive at a measure of the error thus created, by directing that the enumerators, when collecting the schedules, should enquire as to the absence from home of those regularly residing at the house from which the schedule was collected. A note on the back of the schedule would record the reply, and thus it would be possible to state that so many persons of a given district were temporarily away at the time of the Census.

The particulars to be obtained are prescribed in section 4 of the Act. The progressive extension of the Schedule since 1881 is indicated in the subjoined tabular statement :—

Census of	Information prescribed to be obtained.
1881 } 1891 } 1901 }	Name; Sex; Age; Conditions as to Marriage; Relationship to Head of Family; Birthplace; Infirmities (Blind, Deaf, Dumb, Imbecile, or Lunatic).
1881 . 1891 } 1901 }	Rank, Profession, or Occupation. Profession or Occupation.
1891 } 1901 }	(For Wales and County of Monmouth) whether speaking Welsh only or both English and Welsh.
1891 } 1901 }	(For Tenements of less than five Rooms) Number of Rooms occupied.
1901 .	(For those Born Abroad) Nationality.

Each successive schedule has approached more nearly the standard suggested at the St. Petersburg Congress, but that for next year is still deficient in certain minor matters. Language is only dealt with to a very limited extent, viz., to the use of Welsh, with or without English, in Wales and Monmouthshire; and of Gaelic, with or without English, in Scotland. Attempts have been made to secure a religious Census, but the opposition has always been, and probably always will be, too strong. Having regard to the amount now spent on compulsory education, it is

remarkable that no enquiry is to be made as to the results obtained. It would probably be difficult to frame a satisfactory standard, and more so to test the accuracy of the answers given with reference to any standard adopted. In Scotland, information is to be obtained with respect to each dwelling-house, as to "the number of rooms, including a kitchen (if any) as a room, having a window, not being a window with a borrowed light."

The duty of filling up the Schedule was, in 1881, placed upon "every occupier of any dwelling-house or of any distinct storey, or of any apartment in any dwelling-house", and in 1891, on "the occupier or occupiers of every dwelling-house", in each case, so far as such Schedule related to, "all persons dwelling in the house, storey, or apartment occupied by him." In the Act of this year it is prescribed that the Schedule shall be filled up by the occupier of each house or "any part thereof", as "to all persons dwelling in the house, tenement, or apartment occupied by him." The variations in the language manifestly indicate that a difficulty has been experienced in framing an instruction which shall secure a satisfactory return as to the number of inhabited houses, and the numbers of persons dwelling therein. It is important that a good working definition of a dwelling-house should be arrived at, as it is customary to check the inter-censal estimates of population from the number of inhabited houses, either as entered on the rate books, or independently obtained for this special purpose.

A man's home may be either a "house", or a "tenement", or a "flat." By a "house", I should understand a self-contained dwelling, bounded by front, back, and party walls, and standing alone under a roof; by "tenements", the parts of a house described as before when such house is let to more than one independent family, the members of which have no right of access to the rooms of the house beyond those let to them; and by "flats", I should define those self-contained apartments which are under one roof, but cut off from each other by a front door opening on to the common staircase. With such descriptions, the need of the term "apartment" disappears, and with such disappearance there is a gain *quâ* simplicity. Unfortunately, in Scotland, the terms "house" and "tenement" have exactly opposite meanings to those current in England. In this country the "house" contains the "tenement", whilst in Scotland the "tenement" contains the "house." There is in the latter country the further complication due to the fact that the "house", or as it is frequently termed the "land",

may include two or more independent "lettings" occupied by independent families. I would suggest that such sub-divisions of the "house" should be termed "sub-lets." The Scotch authorities are at present engaged in framing a series of definitions to get over the difficulties. Pendant to the descriptions suggested above, we should have "householders", "tenement-occupiers", and "flat-occupiers." Lodgers, not being boarders, would rank as "tenement-occupiers." I may here quote what the Registrar-General for England said with regard to the returns of inhabited houses at the Census of 1891 \* :—

As regards houses, there is a similar uncertainty to that concerning families. The instruction to the enumerators was that they should consider every building that was separated from the next adjoining building by an unbroken party wall, and such only, to be a separate house. There is, however, very good reason for believing that this instruction was not universally observed, and that often a block of buildings, consisting, according to the definition, of several distinct houses, was treated as a single house, while on the other hand portions of one and the same house, held as different tenements, were often counted as separate houses. There is, moreover, very good ground for believing that the introduction into the enumeration book of a new column, in which particulars were to be entered as to the number of rooms in a tenement, has, by confusing the enumerator, materially added to the frequency of these errors, so that the figures must be received with some reservation.

In Scotland the enumerator was required to reckon as a separate house "every dwelling (1) with a distinct outside entrance from "a street, court, lane, road, &c.; or (2) with a door opening "directly into a common stair; but if any such dwelling is "subdivided and occupied by different families, it must be "reckoned as only one house."† According to this latter instruction, a "house" might include "house" or "flat", as already described by me, and the ordinary "tenement" would be ignored.

It is evident, then, that there was considerable confusion prevailing at the last Census. This confusion becomes worse, when we consider what is a "house" for rating purposes, and is made still worse in connection with the terms "inhabited" and "uninhabited."

In my own district we have many "houses", "tenements", and "flats." I know of houses which are split up into

\* *Preliminary Report and Tables*, p. vi

† Quoted by Wilson, *Public Health*, xi, p. 766.



tenements, some of which are rated as single houses, and others rated as individual tenements. A concrete example will explain this best. No. 78, Bravington Road is designed to be occupied as three separate tenements, and may appear on the rate-books as one or three ratings, according to the wish of the owner for the time being. In the former case the premises would count as one "house", and in the latter as three. A block of flats may appear on the rate-books as one "house" or as  $x$  "houses", corresponding to the number of flats therein contained. Then, again, a house appearing in the rate-books as "empty", will not necessarily be "uninhabited", as the place will be rated "empty" even when occupied by a caretaker and his family, possibly including half-a-dozen children. Such house would be returned by the Registrar-General as "inhabited."

Personally, I should like to have the Census returns deal with houses, tenements, and flats under separate headings, and a clear statement made as to the houses which were "empty" but occupied. The tabulation which, to my mind, promises best, would be under the headings of "houses occupied separately"; "No. of inhabitants residing therein"; "houses occupied in tenements"; "No. of tenements contained therein"; "No. of inhabitants residing therein": "No. of blocks of flats"; "No. of separate flats contained therein"; "No. of inhabitants residing therein." Columns distinguishing in each case the numbers of "inhabited", "empty but occupied" and "uninhabited" premises would be required. As to premises building, it would be possible to classify them as "houses" or "flats." It should not be impossible to secure the compilation of the rate-books on the same plan, and thus the work of checking inter-censal estimates would be greatly facilitated, and the estimates themselves rendered more accurate. I question whether, having regard to the greatly altered conditions as to housing, the averaging of the population "per house" has any real value. I think it would be more useful to determine the number of rooms per "home" and the number of persons therein residing.

The attempt made in 1891 to distinguish between "employer" and "employed" was admittedly not a success, nor do I think any question can be framed which will serve to secure a categorical answer in every case. Suppose A employs B to carry out certain work, and B sublets parts of that work to C, D, and others. Is B to consider himself as an employer or as employed? He may do part of the work himself. Many other

examples might be framed to illustrate the difficulties of the matter. In the United States the occupational Census is dealt with apart from the general, and I think that practice might be adopted with advantage here. There is already legislation which provides for much of the necessary information under this head being collected independently at various periods, and the Factories and Workshops Bill,\* to which allusion has already been made, will, if the powers proposed be properly exercised, secure a great deal more.

The provisions of sub-section 5† of section 4 of the Act, taken in conjunction with section 7,‡ appear to me to favour error by enumerating certain persons twice over. It is possible to eliminate all chance of such error by a close comparison of the schedules, but the number of schedules to be dealt with makes such comparison a work of considerable magnitude.

I have already alluded to the question of a standard area for tabulation. The enumerator is directed by section 5, sub-section 2, to record the "counties, boroughs, parishes, and other" "areas for electoral or administrative purposes and the ecclesiastical" "parishes or districts" in which the houses are situated. In the course of the debate on the Bill, Mr. Chaplin promised that the instructions to be given under section 10 should direct that the wards should be taken as the basis of returns, and that in no case should the enumeration area overlap the boundaries of a ward. This is an important step in the right direction, and will prove useful in connection with section 9.§ From my own knowledge of the subject, I can foresee that the work of getting out information, which may be expected to be sought under that section, will be greatly lightened if the medical officers of health be

\* *Vide supra*.

† Section 4 (5).—For the purposes of this section, a person who is travelling or at work on the night of the census day, and who returns to a house on the morning of the following day, shall be treated as abiding in that house on the night of the census day.

‡ Section 7.—The Registrar-General shall, subject to the approval of the Local Government Board, obtain returns of the particulars required by this Act with respect to persons who during the night of the census day were travelling or on shipboard, or for any other reason were not abiding on that night in any house of which account is to be taken by the enumerators, and shall include these returns in the abstracts made under this Act.

§ Section 9.—The Registrar-General may, if he thinks fit, at the request and cost of the council of any county, borough, or urban district, cause abstracts to be prepared containing statistical information with respect to the county, borough, or district which can be derived from the census returns but is not supplied by the census report, and which, in his opinion, the council may reasonably require.

enabled to confer with the superintending registrars, or other responsible officers, as to the outlines of the enumeration areas. The Incorporated Society of Medical Officers of Health has addressed a communication to the Registrar-General urging the desirability of this arrangement, and I have already taken steps with this view in my own district.

On all former occasions the enumerators were required to transcribe the schedules into enumeration books, a rule which has not been re-enacted this year. The Registrar-General has been left free to decide "the mode in which the householders' "schedules are to be copied; . . . the copies to be "summarized, verified, examined, corrected, and otherwise dealt "with." It seems desirable that this work should not be done by the enumerators, but by persons working more immediately under the supervision of the Census Office, so as to secure a uniform interpretation of the schedules. A certain amount of correction is, I presume, inevitable, but perhaps that is a point on which you may hold a different opinion. In America, cards are largely used for tabulating Census returns. I know from my own small experience (I have used them for nearly ten years) that cards do greatly facilitate tabulation, and that the labour of preparation is very trifling.

I think it is the first time that the confidential character of the information obtained has been laid down by the Act. It is now an offence, punishable under the Official Secrets Act, 1889, to unofficially disclose any of the information obtained. I think I am right in saying that at the last Census a considerable amount of information was unofficially communicated to medical officers of health. Having regard to these new enactments, it is satisfactory to note that local authorities are to be able to obtain information other than that set out in the published returns.\* It will be a great disappointment if the Registrar-General exercises his veto to any considerable extent, but possibly the fees which he can charge will favour a liberal interpretation of the section, which, by the way, would probably do something considerable towards reducing the expense of the Census.

With the exception of the preliminary return, no time limit has been prescribed for the issue of the report of the Census. It is to be hoped that steps will be taken to issue such report with the utmost dispatch, as the delay of even one year materially detracts from the value of the Census statistics.

\* *Vide* Section 9, *supra*.

Before closing, I should like to say something with regard to the enumerator. In this country it is customary for the householder, or the persons directed by the Act, to fill up the schedule, and for the enumerator, as far as he can, to examine the schedule, and test its accuracy. I am not sure that it would not be preferable to entrust the filling-up entirely to the enumerator. When I make an enumeration of any part of my district the officers have to fill up the enumeration cards themselves, as I cannot compel the householders to do so. From my experience, I am inclined to think that the time required for the enumerator to fill up the schedule would not be much in excess of that required for him to check and correct the schedule after the average householder has experimented with the document. A little preliminary training would enable him to learn how to extract the information required, and to sift the grain from the chaff contained in the information tendered. I think, too, that more accurate results would be obtained by having the schedule filled by men who had been trained for the work. Of course it is largely a matter of expense, but if the copying into the enumeration books were abandoned, and the schedules were sent direct to the Census Office, it seems not impossible to modify the present practice in the direction indicated without any great increase on the present expenditure. This cannot, however, be done under the new Act. It will here be not out of place to express the hope that the remuneration to be given for the work, however carried out, will be such as to attract men of intelligence and reliability. It seems a false economy to put in an untrustworthy foundation in the form of inaccurate work by the enumerators, by offering such men a wage something less than that obtainable by a skilled mechanic.

In conclusion, I would express an earnest hope that the report of the forthcoming Census will include a volume collating in an adequate manner the statistics of the British Empire. Such return could not fail to impress most forcibly the most ardent little Englander with the grandeur and power of the British Nation—including in that term not only the inhabitants of the United Kingdom, the Mother of Nations, but also those of the Daughter Colonies and Dependencies, soon, I hope, to be welded in one grand Union, primarily for defence, but also for offence.

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## DISCUSSION.

The PRESIDENT (Mr. H. W. Manly) said that the subject of the paper was one of great importance, and had certainly commanded considerable attention recently from numerous societies and associations throughout the country, whether political, economic, social, philanthropic, religious, or in any way concerned with the different phases of national life. Each society naturally thought that its own peculiar duties were the most important, and the Institute of Actuaries was no exception to the rule, and the Council of the Institute had recently petitioned the President of the Local Government Board upon the subject (see page 362). The Institute considered that they had been exceedingly modest in their demands. They had urged the importance of endeavouring to get greater accuracy in the ages; that the numbers living should not be given only in quinquennial groups, but that they should be inserted for every age, so that investigators could make for themselves such combinations as they might wish. They had also pointed out the great advantage of the card system, the easy manipulation of which Dr. Dudfield had commented upon. No doubt the Government had been overwhelmed with suggestions, and although they knew there was wisdom in a multitude of counsellors, it took an exceedingly wise Government department to find out that wisdom. He held that that was all the more reason why the question should be openly discussed, and the Institute, consequently, was greatly indebted to Dr. Dudfield for his paper. The author, naturally, took one view of the subject—that the information should be so given in the returns that a public officer of health could easily deduce the rates of mortality in his district. Censuses, of course, had been a growth. No doubt the original object of a census was to find out the fighting strength of a nation. Then, in ancient Rome, they were told that there was a census every five years, the object being two-fold; first, to re-arrange the military organizations, and, secondly, taxation. Coming down to the present time, with the growth of knowledge and science, the irregular distribution of wealth, the minute subdivisions of labour, and the extension of humanitarian feelings, they required, and justly so, that the census should contain such information, and the statistics be presented in such a form, that they should be of practical use to every section of the community. He did not think that they would ever attain to anything like perfection until there was a permanent census department, and he thought that all who were interested in the subject should join in pressing that upon the Government.

Mr. G. H. RYAN said that it was of great value to the actuarial profession that means should be afforded them from time to time of knowing what other professions thought upon subjects in which a common interest was taken; and it was a matter of congratulation that Dr. Dudfield should have been able to read a paper before the Institute dealing with the important question of census taking, inasmuch as he had thrown light upon many points of interest which might have escaped purely actuarial inquiry. In an early part of his paper the author had expressed his disappointment that the paper had not been read and the discussion had not taken place before the



passing of the Census Bill. Dr. Dudfield was not alone in not making sufficient allowance for the promptitude of the Local Government Board—a promptitude that was not wholly expected. They did, at any rate, learn one thing from their backwardness in these matters, namely, that if they wished to exercise any influence whatever in regard to the policy of the Government in questions relating to the census, they must look ahead and act earlier than they had hitherto done. For example, the question of quinquennial censuses had been mooted by the author of the paper, and it seemed to him (Mr. Ryan) that if they wished to bring any influence to bear upon the authorities in regard to the carrying of that useful and needed reform, they should have all their facts ready, and their arguments marshalled and tested by 1904—say, two years before the date when the census would take place. He would also suggest that in the meantime, between now and 1904, the Council might consider whether the subject of the best mode of enumerating the people, of dealing with the facts, and of constructing life tables and other tables from the rough data, together with an enquiry into the uses to which such tables could be put, might not form an instructive subject for a prize essay; for it was a subject of national importance, somewhat outside the ordinary range of Institute work, and might therefore be of greater and wider interest than usual. With regard to the literature dealing with census questions, in addition to the paper of Mr. Burridge, to which Dr. Dudfield had made a passing reference, it would be remembered that at the Brussels Congress a paper on census taking was read by Mr. McLauchlan. That paper excited a great deal of interest, inasmuch as it enabled the representatives of different countries to exchange views on a matter in which they were mutually concerned, and the result was, in his opinion, extremely instructive. He would also refer to a paper read by Mr. G. F. Hardy, in which that gentleman dealt with the Indian census of 1881. It might be said of Mr. Hardy that he touched no subject that he did not adorn, and in his paper he had certainly given the profession some very valuable and suggestive results. But Mr. Hardy's paper was of use and interest in another respect, in that it afforded the unusual example of a Government department seeking professional advice from outside its own ranks. He ventured to think that on that occasion the Indian Government, which had gone to a leading expert for advice, had not failed to receive material assistance in the great work which it had in hand. It might be that between now and 1902 or 1903, when the census figures would be finally manipulated, the Government might see fit to invite the Institute of Actuaries to make suggestions as to the best treatment of the rough observations. On a previous occasion the Government did so approach the Institute of Actuaries—in connection with the Life Assurance Companies Act,—and the information that it received from that body was, he believed, of no little assistance to them. He felt sure that if the Government were to make any representation or appeal to the Institute with regard to the forthcoming census, the Council would cordially do all in its power to advance the object in view. With regard to the matter immediately under discussion, he should leave the details of the general question of censuses to be dealt with by other speakers, but he was glad to be

able to cordially endorse the opinion which had been expressed from the chair, that the most important reforms that could be expected in the carrying out of the present census were, first, the more exact enumeration of the ages of the people living; and, secondly, the publication of the numbers living at each age. He thought that those facts, if brought together in the most perfect form available—perfect, that is to say, remembering human nature to be what it is—would afford the means of solving many problems which it was now only possible for them loosely to grapple with. One was accustomed also to hear people say that the census returns, coupled with the registration of deaths in the intervening years, afforded an interesting means of ascertaining the mortality among various trades and professions. He was, however, afraid that that information was not entirely trustworthy with regard to the census figures. The period of exposure in any particular trade was not known, and with regard to the deaths for the intervening period there were no means of ascertaining the past history of a man who might die, and be described, in general terms, say, as “gentleman.” An innkeeper, a mariner, or a publican, who might have spent many years of his life in a hazardous occupation, might retire from it, and die under some other designation, and in that way it seemed to him that both the numerator and the denominator of the fraction representing the rate of mortality were distorted. With regard to the more exact enumeration of ages, he ventured to hope that the Government would see its way to make an appeal to the people to treat the question with a proper appreciation of its importance, and to give all the information asked for in the schedules accurately. The Press might also make an appeal to the public spirit of the nation, as it had done recently in a much wider and more important matter, with the result so well known. An appeal of that sort might, he thought, free the national returns from some of the unseemly buffooneries and senseless and wilful mis-statements which had too often disfigured them in the past. By that means the object of the census would be advanced more effectually than by any of the minuter reforms which had been suggested.

Mr. R. TODHUNTER said that although it was no doubt a fact, as Dr. Dudfield had stated in the opening paragraph of his paper, that the standpoint from which he regarded the subject of census taking differed from that of the actuary, still that difference of standpoint did not necessarily involve any conflict of opinion. With all deference to the view expressed by the President as to every society having its own axe to grind in the matter, he ventured to think that the medical officer of health and the actuary were not in the position of competing with each other for the adaptation of the census each to his particular requirements, to the exclusion or limitation of information that might be useful to the other. On the contrary, they were, he thought, absolutely at one in wishing to make the occasion of the census an opportunity of obtaining the fullest possible information that could be secured without so overloading the schedule as to entail any risk of loss of accuracy. One reason for that, apart from the fact that all scientific professions must have an interest in furthering one another's objects, was that it was quite impossible for

the actuary, and equally so, he should suppose, for the medical officer of health, to forecast exactly what his requirements might or might not be. As new subjects of investigation arose, new requirements were developed, and it not infrequently happened, unfortunately, that the way of research was closed in consequence of some necessary statistics not being available. As an instance of that, he might refer to Mr. King's investigation on the subject of family annuities. In that investigation statistics were required showing what proportion of men of a given age would be married men or widowers, and what average family a man dying at a given age might be expected to leave behind him. With regard to the first point, the statistics given in the report of the Registrar-General of the 1881 census were lumped together after age 65, while with regard to the orphanhood of children, neither the censuses nor the death registers afforded any evidence whatever, and it was consequently necessary to have recourse to some special information that had been collected in New Zealand. Similarly, in the case of the problem of finding the present value of an annuity to a man's widow, Mr. King mentioned that there were no statistics available showing the age of a man's wife at his death. That was an instance which indicated how new developments of their science might create a demand for fresh particulars in the matter of vital statistics. On the other hand, cases might occur in which actuarial uses were found for statistics which, at the time they were compiled, had no obvious application to the work of the actuary. Take a case in point. Dr. Dudfield said that the unit area of tabulation had little practical interest to the actuary. At the present time that was a statement which he did not suppose any members present would be disposed to dispute, but it was not impossible that circumstances might arise in which it might become a matter of importance to the actuary to know the numbers living and the numbers dying in separate districts. Last month there was submitted to the Institute a paper containing, among other things, a geographically distributed mortality experience of the Manchester Unity, and that paper suggested that it might become necessary or desirable to construct population mortality tables for separate areas corresponding more or less approximately to the districts in which different industries were carried on, or different conditions of life prevailed. In that case they would certainly want their vital statistics for small areas, and the unit area of calculation would become a matter of considerable importance to them. It seemed to him clear, therefore, that any improvements and extensions of their system of vital statistics ought to be very welcome, whether they could immediately foresee their application to their own work or not. Dr. Dudfield had suggested as an ideal arrangement an annual enumeration, in which the particulars obtained would be limited to the name, sex, and age of each person; and a more complete decennial census. He ventured to think that the actuarial ideal would rather be a continuous record compiled from registers of births, deaths, marriages, immigrations and emigrations, and checked periodically by the census. Such an ideal could not, he thought, be regarded as wholly unattainable, seeing that something of a similar nature was done for a very considerable fraction of the population by a single



insurance office. Such a system would, for many practical purposes, answer admirably; but it would, unfortunately, as far as one could see, break down on the two questions of occupation and internal distribution. He supposed it would be quite practicable by records kept at the ports of embarkation and disembarkation to determine with close accuracy the number of persons leaving Great Britain or entering Great Britain; but it would not, apparently, be practicable to keep such a record of changes of domicile within Great Britain as would admit of an accurate record being maintained of the population or persons living in small areas. Similarly, it would be practically impossible to keep a continuous record of changes of occupation. Hence Dr. Dudfield's plan seemed the only practical ideal—if the phrase might be permitted—and, if the census was to continue to be, as it had been in the past, the foundation of their system of vital statistics, it would be generally agreed that it must be taken more frequently than once in ten years. The changes in the rate of increase of the population were too considerable to admit of an estimated population being interpolated with any reasonable accuracy for so long a period as a decennium. From 1881 to 1891 the rate of increase of the population was very much lower than it had been in any previous decennium over which the records extended. The consequence was that the numbers living, as estimated by the process of interpolation, were over-estimated to an increasing extent as the decennium advanced, and by the end of the decennium there was an error of 700,000, or over 2 per-cent on the entire population. No doubt a closer approximation to the total population would be obtained, and, he believed, was obtained, by taking into account the actual births and deaths, and the emigration and immigration returns, but that did not apply to internal areas, so that the estimated population in internal areas, as found by interpolation, was liable to go very much astray, as Dr. Dudfield showed had been the case in many of the chief cities and towns in the kingdom. As a matter of fact, the interpolated population by the middle of next year was supposed to be  $32\frac{1}{2}$  millions. It would be a matter of interest to see how far the census of next year showed that that estimate was correct. More frequent enumerations would, in all probability, conduce to greater accuracy, as the public would get more used to filling up the census forms. Nothing, apparently, could be clearer than the instructions contained on the last census form, but there was no doubt whatever that many of the schedules were, as a matter of fact, very inaccurately and imperfectly filled up. Quite impossible numbers of females were returned as living at between the ages 20 and 25, and quite impossible numbers of males aged from 65 to 75. Occupations were vaguely stated in spite of explicit instructions on the back of the form; and the question as to whether a person was an employee or an employer was so inadequately answered that it turned out in some industries that there were more employers than employed. Absolute accuracy in regard to age seemed to him to be unattainable, especially in view of the fact that often educated people had very considerable difficulty—as was shown in connection with the controversy as to whether the present year was the nineteenth century or the twentieth century—in keeping their ideas clear in

regard to such phrases as "age last birthday", "years old", and "year of age"; but there seemed no good reason why wilful errors and inaccurate statements should not be minimized. It had already been suggested that something might be done by the Press, and that, he thought, was a suggestion which it was very desirable to take up. Practically it would entail that the census authorities should be prepared to issue specimen copies of their form several weeks before the close of next March, so as to give those newspapers that circulated extensively among the working-classes an opportunity of popularizing the census, and of showing how important it was for the public health and other purposes that accurate results should be obtained. The census authorities might also give actual examples of filling up the form. He supposed that anything in the nature of a "missing occupation" puzzle would be illegal; but, if not, it seemed very probable that a census form partly filled up, in which a competitor had to insert certain missing ages, and relationships to the head of the family, and occupation, and so on, would do a great deal more to familiarize a certain section of the public with the census form than any amount of treatises on the subject. There was just one other point with regard to the ages. He thought the Registrar-General pointed out the fact in his last report that a very large proportion of the population was accustomed to insert the age next birthday in insurance proposal forms. Many people in connection with industrial insurance inserted the age next birthday for themselves and for their children, and it seemed a question for consideration whether it might not be conducive to greater accuracy to ask for the age next birthday instead of the age last birthday. Dr. Dudfield's suggestion as to the enumerators filling up the forms seemed to be open to the objection that in a country such as this, where many of the heads of the families went away to work early in the day and did not return till late at night, the head of the household would not be found at home by the enumerator. There must be many cases in which it would be practically impossible for the enumerator to be on the spot at the right moment. Take the case of a hotel. The manager must go round very early in the morning before his guests had the opportunity of leaving, and ascertain from them by personal enquiry all the particulars which were required by the census form. There could, he thought, be no question as to the advantage of the Registrar-General being left free to deal with the schedules as he thought best. On the occasion of the last census the enumerator was required, as Dr. Dudfield pointed out, to abstract the household schedules in an enumeration book. One thing that happened as a result of that was, that an estimated number of something like from five to ten thousand males were incorrectly recorded as females. The sex of persons had to be indicated by entering the age in one or other of two columns, headed "Male" or "Female", and it seemed that there was a persistent tendency on the part of the enumerator to put the age in the wrong column. More males were incorrectly put in the female columns than females in the male columns. All errors of that sort would be likely to be reduced to a minimum if the work were conducted at a central office under adequate supervision, and he hoped that the question of issuing differently coloured cards, with corners so



cut as to facilitate sorting, would be favourably considered by the Registrar-General. With regard to the compilation of the facts from the schedules, it would certainly be useful if some of the occupations could be more clearly defined. The various branches of unhealthy trades or doubtful occupations ought, if possible, to be stated—for instance, the different classes of persons engaged in the liquor trade, plumbers, lead workers, butchers, licensed grocers, and so on. If possible, they ought to have certain particulars also of persons who had retired from different occupations. On the last occasion, persons retired from different occupations were all classed together as retired from business. What they wanted to know was what occupation a man had been engaged in during his life, because it might have a very important effect upon the mortality in that occupation.

Mr. M. N. ADLER expressed his satisfaction that the topic of the paper they had listened to that evening referred to a more popular subject than was usually brought before the Institute. He thought it only right to mention that the Royal Statistical Society deserved a good deal of credit in getting Parliament to concede several points connected with the census which had been withheld on former occasions. There was no enactment at the present time for having a decennial census, or a periodical census at all. The Act passed last month was headed: "An Act for taking the Census of Great Britain in the year 1901", and there was no intimation as to when the next succeeding census would be. He thought that in all probability, owing to the efforts of the Statistical Society, an enumeration for Great Britain would be taken in 1906, such as was taken for London in 1896. If such a course were adopted, the example of many of the other nations on the continent would be followed. France, Germany and Sweden had acceded to quinquennial enumerations, and he had no doubt that America would soon follow suit. It must be remembered that in America such investigations were of a most elaborate character. In Great Britain the cost of the census of 1891 was £168,000, whereas in the United States the cost amounted to nearly £1,500,000. The American returns, too, were of a most voluminous and elaborate character. He thought the case of India might be mentioned as affording an example of a census among a population who viewed it with hostility at first, and even now circumstances have to be faced there offering immense difficulties. Success was due to the fact that, whilst nearly one million had to be employed to count a population of 300,000,000, the superintendents were men of experience and ability. At the International Congress held in 1872 at St. Petersburg, the minimum requirements with regard to census-taking had been agreed upon. Other nations had very much exceeded those minimum requirements, but England had held back. The two points not even now asked in the English census referred to religion and education. With regard to religion, he might mention that in Ireland the question was asked, but it was understood that to reply thereto was optional. In the census of 1881 about 350 people availed themselves of the permissive clause to withhold information. In 1891 the number had increased, there being some 700 who refused to state to what religion they belonged.

The question of education was not now a matter of such importance. Since the Education Act of 1870 had been passed, it might be assumed that all people below the age of 40, except those who had immigrated into this country, could read and write. He agreed with Dr. Dudfield's recommendation that the enumerators, when collecting the schedules, should inquire as to the absence from home of those regularly residing at the house from which the schedule was collected. In that way it might be found that certain individuals having a repugnance to answer the questions could be brought to book. Mr. Ryan had referred to Mr. G. F. Hardy's very excellent paper in connection with the Indian census. The disturbing effects of famine, the uncertainty of the rate of increase, did not baffle Mr. Hardy. The disproportion between the two sexes arose, it was first thought, from infanticide in the case of the female children, but it turned out afterwards that there is a most inveterate horror in India of children living at a certain age and being unmarried. It was considered a great degradation to a household to contain one or more unmarried females of nubile age. There were thousands of cases where either the presence of such girls was concealed, or their ages understated, and it could easily be understood how this vitiated the records. He hoped full use would be made of the power given to County Councils under clause 9 of the Act to cause such statistical information as may appear reasonable to be collected from the census returns. Full play would thus be given to local investigations.

Dr. GINSBURG said that his friend, Mr. Adler, had mentioned the Statistical Society, and he would like to say something of what that Society, together with the Institute of Actuaries, had done. First of all, he would like to make one or two observations on the Act itself. The Act made arrangements for having a census in 1901. People talked about decennial censuses in this country, and in point of fact they had one; but it must be remembered that they had that census by the grace of the Government of the day, and not by any permanent enactment—that was to say, the present census was a practice, but it was not an institution. He thought they must try to have that practice converted into an institution, and a quinquennial one. They had already made some progress; he thought four points had been obtained, if not five. In the first place, they had got the principle recognized—that when the census was to be taken the Government would not meddle with the details of how it was to be done. More was being left to the Registrar-General, and he thought that was the right thing to do. They might not this time get the card system, which Dr. Dudfield was so anxious to see; but, at all events, the way was being paved for it. The Government having admitted the principle, was not likely to go back in future Acts. Then they had got an amendment with regard to the statement of nationality, and that was a thing which would be exceedingly useful in regard to the alien immigration question. There was also the modification brought in by the request for particulars as to whether, if houses were uninhabited technically, they were occupied or not. That was also to be noted by the enumerator, and that would be invaluable for rating purposes. Finally, they had obtained the concession that the local authorities would be able, by paying for it, to use for their own purposes the statistics which had been collected.

If they could bring pressure to bear on the Government, and if they could secure the quinquennial census, he thought that probably everything that was wanted would follow, including permanent census officers. By having capable trained men to deal with the tabulation, the tabulation would be brought out more quickly, and by having a permanent census office it would be found that larger questions could be dealt with, and more careful detail work could be done.

On the motion of the President, a vote of thanks to the author was carried with acclamation.

Dr. DUDFIELD, in replying, said he was very much obliged to the members for the kind way in which they had received his paper, to which, however, he had not been able to devote as much time as he would have liked. He would merely, in reply, mention two points. The first one Mr. Ryan touched upon—viz., the question of the effect of occupation on mortality. That was intimately bound up, not only with the manner in which the occupations were entered in the census returns, but also with the very large question of the certification of death. That, at the present moment, in the opinion of those who were best qualified to judge, was in a very unsatisfactory condition. He was hoping that the time would come when the recommendations of the Death Certification Committee of the House of Commons of some few years back would be brought forward again. The certification of death was made a set duty, which was paid for, and certain specific information demanded. When those recommendations came forward again, then would be the time for the Institute and kindred societies to move in the matter and get the information that was now wanted. With regard to what Mr. Todhunter had said, nearly the whole of his remarks were strongly in favour of his (Dr. Dudfield's) suggestion—that the enumerator himself ought to fill up the schedule, because almost all he said pointed to the fact that the average householder did not know what to do with the schedule. It was much too complicated, and the very elaborate instructions which were endorsed raised great contention. If an educated enumerator were appointed to do the work, he did not see any real difficulty in the matter of time, because if there was a sufficient number of enumerators they could do it. The male householder was very often not the best person to get information from—he spoke from considerable experience in the matter—and the female part of the establishment could give the enumerator far better information than the male.

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### Census, 1901.

THE Bill for taking the Census in 1901 in England and Scotland, as introduced in the House of Commons by the Right Honourable Henry Chaplin, M.P., President of the Local Government Board, on 19 February 1900, having been brought under the attention of the Council, a Committee was appointed to consider it with a view of making any recommendations which appeared to be desirable. The Committee consisted of the President and Honorary Secretaries (*ex officio*), Messrs. G. F.

Hardy, W. O. Nash, G. H. Ryan, and Frank B. Wyatt, and power was given them to communicate with any other Bodies interested.

The Committee opened communications with the Faculty of Actuaries in Scotland, and interchanged views. The Faculty decided to memorialize Lord Balfour of Burleigh, the Secretary of State for Scotland, and submitted a draft of their Memorial.

The Committee prepared a Memorial to the Right Honourable Henry Chaplin, President of the Local Government Board, which was submitted to the Council and adopted on 13 March 1900, and forwarded to the President of the Local Government Board, with a request that he would receive a deputation. It was resolved that, in the event of the President of the Local Government Board consenting to receive a deputation, the Faculty of Actuaries and the Royal Statistical Society be invited to join with the Institute in forming the deputation.

In acknowledging the Memorial, Mr. Chaplin stated that it did not appear to him to be necessary to trouble a deputation to attend in connection therewith.

Appended are the Memorial of the Institute of Actuaries, and copies of "The Census (Great Britain) Act, 1900", and "The Census (Ireland) Act, 1900."

To

THE RIGHT HONOURABLE

HENRY CHAPLIN, M.P.,

*President of the Local Government Board,  
Whitehall, London, S.W.*

THE MEMORIAL OF THE INSTITUTE OF ACTUARIES OF GREAT  
BRITAIN AND IRELAND, INCORPORATED BY ROYAL CHARTER.

SIR,—The Institute of Actuaries of Great Britain and Ireland was constituted in the year 1848, and in 1884 was Incorporated by a Royal Charter for the purpose (among other things) of "promoting the study of the Doctrine of Probabilities, of Vital Statistics, and Statistics in general." The management and direction of its affairs are entrusted to a Council, who are your present Memorialists.

In view of the near approach of the date for the Census of the United Kingdom in 1901, the Memorialists respectfully beg leave to submit for your consideration the following recommendations with regard to taking the same:—

#### I.—THE IMPORTANCE OF CORRECT AGES.

From the point of view of those having to do with vital statistics, the most important feature in the Schedule is the column in which the ages of the various members of the household are returned; and



it is here that most inaccuracies are known to occur, thus destroying in a great measure the value of the data.

It is found, and has been pointed out in the several Registrars' Reports of past Censuses, that the ages are given largely in round numbers—as of the nearest decennial or quinquennial age—instead of the exact age; and other mis-statements are found to appear. The Memorialists are of opinion that a greater measure of correctness might be obtained if words of special caution were inserted in the heading of column 5, and an explanatory instruction printed, pointing out that the correct age last birthday must be given, and that to state the age in round numbers was equivalent to giving *False Information, and punishable accordingly*.

This instruction should, in the opinion of the Memorialists, occupy a position of at least equal prominence with the numerous General Instructions (five in number) and Special Instructions (nineteen in number), which all relate to the heading “Profession or Occupation.”

The following is suggested as the

*Instruction for filling up the Column headed “Age last Birthday” :—*

“The exact age last birthday must be inserted, it is not sufficient

“to give the age at the nearest period of five or ten years.

“Any such erroneous return is liable to be considered as

“equivalent to giving ‘False Information, and punishable

“accordingly.’”

Suggested heading for Column 5 :—

“Age last Birthday.

“Exact age must be given.

“See special instruction.”

## II.—THE NUMBERS AT INDIVIDUAL AGES SHOULD BE PUBLISHED.

To obtain an accurate estimate of the extent of the errors indicated in Clause I, and the ages at which they occur, it would be necessary to have the numbers tabulated at the individual ages throughout life, and not in groups of five years only as at present. The publication in this way of the whole of the raw material would aid the selection of the methods of redistribution and graduation, and would very greatly facilitate the operations of those who have the preparation of mortality tables.

## III.—THE PUBLICATION OF THE RETURNS FOR INDIA AND THE COLONIES AS WELL AS FOR THE UNITED KINGDOM, IN A FORM SUITABLE FOR GENERAL USE BY THOSE WHO ARE ENGAGED IN THE INVESTIGATION OF ECONOMIC AND SOCIAL QUESTIONS.

The Memorialists desire to respectfully draw the attention of the Government to the importance of making such arrangements as will secure that the valuable information collected in connection with the Censuses of the United Kingdom, India, and the Colonies, and the corresponding Registers of Death, shall, as far as possible, be put into shape and published in a convenient form. The records of those Censuses and Deaths are capable of affording information of great



interest and importance, and it is desirable that they should be framed in such a way as to afford every possible facility to those who are engaged in the investigation of economic and social questions. Such records are especially capable of throwing useful light on the rates of mortality in various occupations and in various parts of the Empire and its Dependencies. Much of the available information, however, has not hitherto been accessible in any useful shape. The Memorialists respectfully suggest that full provision should especially be made for calculating from the Census Returns and Registers of Death, the rates of mortality among persons following dangerous occupations, and among Europeans residing in unhealthy climates, and for making information on those subjects available to the public.

#### IV.—ADVANTAGES OF THE CARD SYSTEM.

The Memorialists further recommend the use of the Card System, as now adopted in the Tabulation of the Censuses of some of the Colonies. By the ease with which cards can be sorted according as the tabulation is required according to age, profession, &c., an immense amount of time and labour is saved; their adoption might therefore be expected to be attended by a considerable saving in expense.

For the form of the card reference may be made to that used in the New South Wales Enumeration (1891) Report, page 18, where also is given a full explanation of the advantages of the Card System. A modification in accordance with the information required in the "England and Wales" Schedule would be

*District*... *Schedule*.....

*Age*

*Condition*

(*M. W. or S.*) \*

*Prof<sup>n</sup> or Occup<sup>n</sup>*

*Grade*

(*a. b or c*)

*Birthplace*

*Infirmity (if any)*..... \*

It would be advisable to have different coloured cards for males and females.

\* Married, Widower, Widow, or Single.

*a*, Employer; *b*, Employed; *c*, Neither *a* nor *b*, but working on own account.

\* Deaf, Dumb, Blind, Lunatic, Imbecile or Idiot.

The object of cutting the corner of the card is that any card in a packet, placed face downwards or upside down, can be detected.

V.—THE APPOINTMENT OF A PERMANENT CENSUS BRANCH IN  
THE GENERAL REGISTRY OFFICE FOR ENGLAND AND  
WALES.

The Memorialists are informed that the Royal Statistical Society have strongly recommended to the Government the institution of a permanent branch in the General Registry Office for England and Wales, suggesting that such a department might undertake the work of making available to the public the principal results of the several Censuses of the United Kingdom, India, and the Colonies. The Memorialists desire warmly to support this recommendation. They believe that great advantages would accrue from the work of collecting and tabulating the Census Statistics being entrusted to a permanent staff, who would gradually acquire special skill in this department, and would be ready to take up the extra work of each recurring Census with greater facility and smoothness than the existing arrangements admit of.

In the name and by authority of the Council,

H. W. MANLY,  
*President.*

A. F. BURRIDGE,  
ERNEST WOODS,  
*Hon. Secretaries.*

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63 VICT.—CHAPTER 4.

AN ACT for taking the Census for Great Britain in the year  
One thousand nine hundred and one.

[27th March, 1900.]

BE it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

1. A Census for Great Britain shall be taken in the year one thousand nine hundred and one, and the census day shall be Sunday the thirty-first day of March in that year.

2.—(1.) The Local Government Board shall superintend the taking of the census.

(2.) The Registrar-General shall, subject to the approval of the Board, prepare and issue such forms and instructions as he deems necessary for the taking of the census.

(3.) The expenses incurred, with the approval of the Treasury, for the purposes of the census, shall be paid out of money provided by Parliament.

3.—(1.) For the purposes of the census every registration sub-district shall be divided into enumeration districts, and an enumerator shall be appointed for each enumeration district.

(2.) Overseers of the poor and relieving officers for poor law unions shall, if so required by the Local Government Board, act as and be enumerators for the purposes of this Act.

4.—(1.) Schedules shall be prepared by or under the direction of the Local Government Board for the purpose of being filled up by or on behalf of the several occupiers of dwelling-houses, with the following particulars, and no others, namely, particulars showing—

- (a) the name, sex, age, profession or occupation, condition as to marriage, relation to head of family, birth-place, and (where the person was born abroad) nationality of every living person who abode in every house on the night of the census day; and
- (b) whether any person who so abode was blind or deaf and dumb, or imbecile or lunatic; and
- (c) where the occupier is in occupation of less than five rooms, the number of rooms occupied by him; and
- (d) in the case of Wales or the county of Monmouth, whether any person who so abode (being three years of age or upwards) speaks English only or Welsh only, or both English and Welsh.

(2.) Every enumerator shall in the course of the week ending on the Saturday next before the census day leave at every dwelling-house within his enumeration district one or more of these schedules for the occupier thereof or any part thereof, and on every such schedule shall be plainly expressed that it is to be filled up by the occupier for whom it is left, and that the enumerator will collect all such schedules within his district on the Monday then next following.

(3.) Every occupier for whom any such schedule has been so left shall fill up the schedule, to the best of his knowledge and belief, so far as relates to all persons dwelling in the house, tenement, or apartment occupied by him, and shall sign his name thereto, and shall deliver the schedule so filled up to the enumerator when required so to do.

(4.) In this section the expression “dwelling-house” shall include every building and tenement of which the whole or any part is used for the purpose of human habitation, and where a dwelling-house is let or sub-let in different tenements or apartments and occupied distinctly by different persons or families a separate schedule shall be left with or for and shall be filled up by the occupier of each such distinct tenement or apartment.

(5.) For the purposes of this section, a person who is travelling or at work on the night of the census day, and who returns to a house on the morning of the following day, shall be treated as abiding in that house on the night of the census day.

5.—(1.) Every enumerator shall visit every house in his district, and shall collect all the schedules so left within his district, from house to house, and so far as may be possible on the day next following the census day, and shall complete such of the schedules as on delivery thereof to him appear to be defective, and correct such as he finds to be erroneous, and shall copy the schedules, when completed and corrected, and shall furnish a return according to the best information which he is able to obtain, of all the persons present within his district on the night of the census day, but not included in the schedules collected by him.

(2.) Every enumerator shall also furnish the prescribed particulars as to whether or not houses are occupied or inhabited, and as to

the counties, boroughs, parishes, and other areas for electoral or administrative purposes, and the ecclesiastical parishes or districts, in which the houses are situate.

6. The governor, master, or chief resident officer of every prison, workhouse, hospital, or lunatic asylum, and of every public or charitable institution which may be determined upon by the Registrar-General, shall be the enumerator of the inmates thereof, and shall conform to such instructions as may be sent to him by the authority of the Local Government Board for obtaining the returns required by this Act, as far as may be practicable, with respect to the inmates.

7. The Registrar-General shall, subject to the approval of the Local Government Board, obtain returns of the particulars required by this Act with respect to persons who during the night of the census day were travelling or on shipboard, or for any other reason were not abiding on that night in any house of which account is to be taken by the enumerators, and shall include these returns in the abstracts to be made under this Act.

8.—(1.) The Registrar-General shall, subject to the approval of the Local Government Board, prepare a preliminary abstract and a detailed abstract of the census returns.

(2.) The preliminary abstract shall be printed and laid before both Houses of Parliament within five months next after the census day, if Parliament be then sitting, or if Parliament be not then sitting, then within the first fourteen days of the session then next ensuing.

(3.) The detailed abstract shall be printed and laid before both Houses of Parliament at as early a date as may be found practicable.

9. The Registrar-General may, if he thinks fit, at the request and cost of the council of any county, borough, or urban district, cause abstracts to be prepared containing statistical information with respect to the county, borough, or district, which can be derived from the census returns but is not supplied by the census report, and which, in his opinion, the council may reasonably require.

10.—(1.) Instructions issued under this Act may prescribe, among other things—

- (a) the mode in which enumeration districts are to be formed and enumerators appointed; and
- (b) the duties of superintendent registrars, registrars, enumerators, and other persons employed under this Act; and
- (c) the mode in which the householders' schedules are to be copied and the persons to whom the schedules and copies are to be delivered; and
- (d) the persons by whom and the mode in which the copies are to be summarized, verified, examined, corrected, and otherwise dealt with; and
- (e) the allowances to be paid to persons employed under this Act; and
- (f) the mode in which and the persons by whom the amount of the allowances payable in respect of each registration district is to be certified, and the persons by whom and the mode in which the payments are to be made; and
- (g) anything authorized by this Act to be prescribed.

(2.) The scale of allowances payable under this Act shall be subject to the approval of the Treasury.

11.—(1.) If any superintendent registrar, registrar, enumerator, or other person employed under this Act, makes wilful default in the performance of any of his duties under this Act, or makes any wilfully false declaration, he shall for each offence be liable on conviction under the Summary Jurisdiction Acts to a fine not exceeding five pounds.

(2.) If any occupier for whom a schedule is left under this Act—

- (a) wilfully refuses, or without lawful excuse neglects, to fill up the schedule to the best of his knowledge and belief, or to sign and deliver it as by this Act required; or
- (b) wilfully makes, signs, or delivers, or causes to be made, signed, or delivered, any false return of any matter specified in the schedule; or
- (c) refuses to answer, or wilfully gives a false answer to, any question necessary for obtaining the information required to be obtained under this Act;

he shall for each offence be liable on conviction under the Summary Jurisdiction Acts to a fine not exceeding five pounds.

(3.) If any person employed in taking the census communicates, without lawful authority, any information acquired in the course of his employment, he shall be guilty of a breach of official trust within the meaning of the Official Secrets Act, 1889, and that Act shall apply accordingly.

12. In the application of this Act to Scotland—

- (1.) “Secretary for Scotland” shall be substituted for “Local Government Board” and “Board”; “Registrar-General for Scotland” for “Registrar-General”; “registration district” for “registration sub-district”; “burgh” for “borough”; “poorhouse” for “workhouse”; and “police burgh” for “urban district”:
- (2.) The expression “council” shall include the commissioners of a police burgh:
- (3.) The schedules under this Act shall include particulars showing whether any person who abode in any house on the night of the census day (being three years of age or upwards) speaks English only or Gaelic only, or both English and Gaelic:
- (4.) The particulars to be furnished by the enumerators shall show, with respect to each dwelling-house, the number of rooms, including a kitchen (if any) as a room, having a window, not being a window with a borrowed light:
- (5.) Sheriffs, sheriff clerks, chief magistrates, town clerks, inspectors of poor and assistant inspectors of poor, shall perform such duties as may be prescribed, including, if so prescribed, such duties as were imposed on them by the Census (Scotland) Act, 1890.

13.—(1.) This Act shall not extend to Ireland.

(2.) This Act may be cited as the Census (Great Britain) Act, 1900.



## 63 VICT.—CHAPTER 6.

AN ACT for taking the Census for Ireland in the year One thousand nine hundred and one.

[9th April, 1900.]

BE it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1. A Census for Ireland shall be taken in the year one thousand nine hundred and one in the manner hereinafter directed, and the census day shall be Sunday the thirty-first day of March in that year.

2.—(1.) Such officers and men of the police force of Dublin metropolis and of the Royal Irish Constabulary as the Lord Lieutenant may direct, together with such other persons as the Lord Lieutenant may appoint to assist therein, shall act as and be enumerators for the purposes of this Act.

(2.) Every enumerator shall, upon the Monday following the census day, and such one or more next consecutive days as the Lord Lieutenant may fix, visit every house within the district assigned to him between the hours of half-past eight in the forenoon and six in the afternoon, and take an account in writing, according to such instructions as may be given to him by the chief or under secretary to the Lord Lieutenant, of the number of persons who abode therein on the night of the census day, and of the sex, age, religious profession, birthplace, and occupation of all such persons.

(3.) Every enumerator shall take an account of the number of inhabited houses and of uninhabited houses and of houses then building within his district and of the number of rooms occupied by any occupier who is in occupation of less than five rooms; and shall also furnish such particulars as may be directed as to the counties, boroughs, towns, districts, and other areas for electoral or administrative purposes in which the houses are situate.

(4.) The enumerators shall also take an account of all such further particulars as they may be directed to inquire into by such instructions as are authorized to be issued under this Act.

(5.) Every enumerator may ask all such questions of all persons within his district respecting themselves or the persons constituting their respective families, and respecting such further particulars, as may be necessary for the purpose of taking the said accounts.

3. The Governor, master, or chief resident officer of every prison, workhouse, barrack, hospital, or lunatic asylum, and of every public or charitable institution which may be determined upon by the Lord Lieutenant, shall act as and be the enumerator of the inmates thereof, and shall conform to such instructions as may be sent to him by the authority of the Lord Lieutenant for obtaining the returns required by this Act, so far as may be practicable, with respect to such inmates, but the initial letters only of the Christian names and surnames of such inmates shall be stated in any such return.

4. The Chief Secretary shall obtain returns of the particulars required by this Act with respect to all houseless persons, and all

persons who during the night of the census day were travelling or on shipboard, or for any other reason were not abiding on that night in any house of which account is to be taken by the enumerators, and shall include such returns in the abstract to be laid before Parliament.

5.—(1.) The chief or under secretary to the Lord Lieutenant shall prepare and issue such forms and instructions as he may deem necessary for the taking of the census.

(2.) Subject to the provisions of this Act, the census shall be taken by means of, and in the manner prescribed by, the several forms and instructions which were issued under the authority of the Census (Ireland) Act, 1890, and which are contained in the Appendix to the General Report of the Commissioners appointed under that Act, dated the twenty-third day of June, one thousand eight hundred and ninety-two, and presented to both Houses of Parliament by command of Her Majesty, and such matters and particulars as were contained in and prescribed by the said forms and instructions or as are required by this Act, and no other matters or particulars, shall be inserted in the forms and instructions to be prepared under the authority of this Act, and no question shall be put for the purpose of obtaining information other than the information required by such forms and instructions.

(3.) The expenses incurred with the approval of the Treasury, for the purposes of the census shall be paid out of moneys provided by Parliament.

6.—(1.) Every enumerator shall sign and certify the account taken by him, and make a statutory declaration, to the effect that the said account has been truly and faithfully taken by him, and that, to the best of his knowledge, the same is correct, so far as may be known, and shall deliver the same to such officer of the said police force, or of the Royal Irish Constabulary, or other person, as may be appointed by the Lord Lieutenant to receive the same from him.

(2.) The accounts shall be examined, corrected, certified, and transmitted in such manner and within such time as the Lord Lieutenant may direct, and the same shall be digested and reduced into order, under the direction of the chief or under secretary to the Lord Lieutenant, by the Registrar-General of Births, Deaths, and Marriages in Ireland, and by such other persons as the Lord Lieutenant may appoint for that purpose.

(3.) An abstract of the accounts taken under this Act shall be laid before both Houses of Parliament within twelve months after the census day, if Parliament be then sitting, or, if Parliament be not then sitting, within the first fourteen days of the session then next ensuing.

7.—(1.) If any enumerator makes wilful default in the performance of any of his duties under this Act, he shall for each offence be liable on conviction under the Summary Jurisdiction (Ireland) Acts to a fine not exceeding five pounds.

(2.) If any person refuses to answer or wilfully gives a false answer to any question necessary for obtaining the information required to be obtained under this Act, he shall for each offence

be liable on conviction under the Summary Jurisdiction (Ireland) Acts to a fine not exceeding five pounds: Provided that no person shall be subject to any such penalty for refusing to state his religious profession.

(3.) If any person employed in taking the census communicates without lawful authority any information acquired in the course of his employment, he shall be guilty of a breach of official trust within the meaning of the Official Secrets Act, 1889, and that Act shall apply accordingly.

8. A certificate from the General Register Office, purporting to be signed by the Registrar-General of Births, Deaths, and Marriages in Ireland, shall be admitted in any court of law as evidence of the population, at the census taken under this Act, of any county, borough, town, district or other area to which it refers, and the said Registrar-General shall be bound, if possible, to deliver such certificate to any person on payment of a fee of one shilling.

9. This Act may be cited as the Census (Ireland) Act, 1900.

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*On the Legal Position of a Purchaser (for Value) from the Assignee under a Voluntary Settlement, in the event of the subsequent Bankruptcy of the Settlor. By GEORGE J. LIDSTONE, F.I.A., Assistant Actuary of the Alliance Assurance Company.*

IT would appear, from some of the answers given by candidates in the recent Final Examination for the Fellowship of the Institute of Actuaries, that considerable misapprehension exists as to the effect of the latest decision of the Courts with reference to the subject of this note. It may, therefore, be useful to deal briefly with the question in the pages of the *Journal*.

Section 47 of "The Bankruptcy Act, 1883", enacts as follows: \*

- "(1) Any settlement of property not being a settlement made  
" before and in consideration of marriage, or made in favour  
" of a purchaser or incumbrancer in good faith and for  
" valuable consideration, or a settlement made on or for the  
" wife or children of the settlor of property which has  
" accrued to the settlor after marriage in right of his wife,  
" shall, if the settlor becomes bankrupt within two years  
" after the date of the settlement, be void against the

\* The section does not apply to the administration in bankruptcy of the estate of a deceased insolvent under Section 125 of the Act (Exp. O.R., *in re* Gould, 19 Q.B.D. 92).

“trustee in the bankruptcy,\* and shall, if the settlor becomes bankrupt† at any subsequent time within ten years after the date of the settlement, be void against the trustee in the bankruptcy, unless the parties claiming under the settlement can prove that the settlor was at the time of making the settlement able to pay all his debts without the aid of the property comprised in the settlement, and that the interest of the settlor in such property had passed to the trustee of such settlement on the execution thereof.

“(3) ‘Settlement’ shall for the purposes of this Section include any conveyance or transfer of property.”

On this Section the question arises whether in either of the events specified the settlement is absolutely void *ab initio*, in which case the title of anyone claiming through the voluntary assignee fails equally with that of the voluntary assignee himself; or whether it becomes void from the date of the bankruptcy only, and in respect only of such part of the property as may not have been previously dealt with, *boná fide*, and for value, by the voluntary assignee. To put the question in a more colloquial way—does the trustee in bankruptcy step into the shoes of the original settlor as if no settlement had been executed, or does he only obtain such rights as remain vested in the voluntary assignee at the date of the settlor’s bankruptcy? The following cases bear upon this question:

(1) *In re Holden ; ex parte the Official Receiver* : 20 Q.B.D. 43 (1887).

This case was argued before a Divisional Court consisting of Justices Cave and A. L. Smith, on appeal against the order of the Judge of the County Court of Halifax. “There had been a good deal of litigation between the settlor and the trustees of the settlement, and the trustees had incurred some costs which the settlor tried

\* The fact that a settlement has been set aside under the Section does not entitle the trustee to stand in the position of the beneficiaries under the settlement so as to take priority over mortgagees and incumbrancers ranking after the settlement; the trustee takes the property subject to all such mortgages and incumbrances (provided they were created *boná fide* prior to the bankruptcy)—see *Sanguinetti v. Stuckey’s Banking Co.*, 1895, 1 Ch. 176. It would seem that the settlement is only avoided so far as is necessary to satisfy the debts of the bankrupt and pay the costs of the bankruptcy, and that the title to the balance (if any) is unaffected (*Re Sims*, exp. *Sheffield*, 3 Mans. 340).

† As to the time when the bankruptcy is deemed to commence, see Section 43 of the Act.

“to evade paying.” The settlor was adjudged bankrupt, and the Official Receiver applied that the settlement might be declared void under the section quoted above. The trustees did not resist the application, but they claimed to have a lien on the settled property in respect of their unpaid costs in the previous action. “The specific question was whether the trustees . . . . . who, according to the ordinary rules of equity with regard to a valid settlement, were entitled to a lien on the property for those costs . . . . . were to be deprived of their costs under Section 47 of the Act of 1883. Of course, they could have no claim to them if the trustee in bankruptcy could go behind their title.” The Court held that the trustees whose claim arose *prior* to the bankruptcy, did not lose their lien on the property by reason of the settlement being set aside in favour of the Official Receiver, who therefore took the property *subject to the trustees’ lien*.

(2) *In re Briggs and Spicer*: (1891) 2 Ch. 127.

In this case, upon a summons under “The Vendor and Purchaser Act, 1874”, it was held by Mr. Justice Stirling that purchasers from the trustees of a voluntary settlement would be “parties claiming under the settlement” within the meaning of Section 47 of the Bankruptcy Act, and therefore liable to have their title upset by the avoidance of the settlement under that Section.

(3) *In re Vansittart; ex parte Brown*: (1893) 2 Q.B. 377.

This case, which was heard before Mr. Justice Vaughan Williams, is sufficiently described by the head-note to the report, namely:—

“Although s. 47 of ‘The Bankruptcy Act, 1883’, which ‘avoids a voluntary settlement of property if the settlor becomes bankrupt within two years after the date of the settlement, contains no proviso for the protection of a purchaser in good faith and for valuable consideration, yet the title of such a purchaser from a beneficiary under the settlement, and without notice of the settlement, will be upheld against the trustee in bankruptcy of the settlor.’”

*In re Briggs and Spicer* (*vide supra*) was considered, but the Judge came to the conclusion that the question Justice Stirling had to decide there was different from the question then before him. It should be noted that in



this case (No. 3) the settled property consisted of chattels which were transferred by delivery, so that there was nothing to warn the purchaser that there had been a voluntary settlement.

(4) *In re Brall; ex parte Norton*: (1893) 2 Q.B. 381.

In this case, which was also heard before Justice Vaughan Williams, the settlement was an assignment of leaseholds. The decision was practically the same as in case No. (3), and the head-note is as follows:

“The expression ‘void’ in s. 47 of ‘The Bankruptcy Act, 1883’—which enacts that voluntary settlements of property shall, if the settlor becomes bankrupt within two years after the date of the settlement, be void against the trustee in the bankruptcy—must be construed as meaning ‘voidable’ and not absolutely void, and a *bonâ fide* purchaser for value from the donee under such a voluntary settlement has a good title against the trustee in bankruptcy even if he purchased with notice that the donee claimed under a voluntary settlement.”

A few months after the cases (3) and (4) were decided, one of the offices took the opinion of Mr. H. Burton Buckley, Q.C. (now Mr. Justice Buckley), who stated that he did not agree with *In re Brall*, and even if he did, it seemed to him in direct conflict with *In re Briggs and Spicer*, and in such circumstances he certainly could not advise that the Company could safely proceed upon the footing that the law was rightly laid down in *In re Brall* and wrongly laid down in *In re Briggs and Spicer*. This opinion was printed *in extenso* in a reprint of papers issued by the Life Offices Association.

(5) *In re Carter and Kenderdine's Contract*: (1897) 1 Ch. 776.

In this, which must now be considered the leading case, the question arose, in its neatest form, on an application under “The Vendor and Purchaser Act, 1874”, for a declaration that the vendors (who were trustees under a voluntary settlement executed in March, 1896) could make a good title to the property, which they had agreed to sell, notwithstanding the provisions of Section 47 of “The Bankruptcy Act, 1883.” The case was heard in the first instance before Mr. Justice North, who held that, in view of the conflict of authority shown by the preceding cases

(2, 3, and 4), the title was not such as could be forced upon a purchaser; and he dismissed the application. The trustees appealed, and the case was fully argued before a very strong Court, consisting of Lords Justices Lindley (late Master of the Rolls), A. L. Smith, and Rigby, who unanimously decided that (to quote the head-note in the Law Reports):

“According to the true construction of Section 47 of ‘The Bankruptcy Act, 1883’, a voluntary settlement is not void against the settlor’s trustee in bankruptcy from its date, but is only void against the trustee from the time when his title accrues; so that if before that time the property comprised in the settlement has been sold *bonâ fide* to a purchaser for value, the title of the purchaser will be good as against the trustee.

“*In re Brall*, 1893, and *In re Holden*, 1887, approved.

“*In re Briggs and Spicer*, 1891, over-ruled.”

Each of the Lords Justices delivered a detailed judgment: it will be sufficient here to quote the following extract from that of Lord Justice Rigby:

“I do not think it is possible that the Legislature . . . should have left a purchaser taking a title under a perfectly honest voluntary settlement entirely without protection, in the event of the bankruptcy within two years or ten years, as the case may be, of the settlor . . . I have not the slightest doubt in my own mind that *In re Holden* (*vide* No. 1, *supra*) was correctly decided; and it comes to this, that *every equity* which has been acquired before the act of bankruptcy, which is the beginning of the bankruptcy, is to be respected, and is not in any way hit or interfered with by Section 47.”

In view of the strength of the Court and the unanimity of its judgment (agreeing as it does with the decision of the Divisional Court in *Holden In re*, and of Mr. Justice Vaughan Williams in *Vansittart In re* and *Brall In re*), the above decision may fairly be taken as an authoritative statement of the law on the subject.

In all the cases cited above, the title in question was derived directly from the assignee under the voluntary settlement, not from beneficiaries dealing with equitable interests in settled property of which the voluntary assignees were trustees. In view, however, of the language used in the judgments, and particularly the remarks of Lord Justice Rigby quoted above, there can be no

doubt that the assignee of an equitable interest would be equally protected, a view which is confirmed by the head-note of *In re Carter, &c.*, in the *Law Journal Reports*, namely:

“ . . . . . *bonâ fide* purchasers for value  
 “ who have (before the bankruptcy of the settlor) purchased  
 “ property comprised in the settlement, *whether from the*  
 “ *trustees of the settlement or the volunteers claiming*  
 “ *under it, get a good title.*”

It remains to consider the effect of the Statute of Elizabeth (13 Eliz. cap. 5), by which conveyances of certain kinds of property in fraud of creditors were made “utterly void, frustrate, and of none effect.” In one way this Act is of wider application than Section 47 of the Bankruptcy Act, because there is no limit of time within which the bankruptcy must take place in order to the avoidance of the settlement. On the other hand, in the Statute of Elizabeth the *onus probandi* lies on the person who seeks to have the settlement avoided, as it is necessary for him to prove that the settlor was not at the time of making the settlement able to pay his debts without the aid of the settled property; whereas under the Bankruptcy Act the onus of proving the contrary lies on the persons who claim under the settlement, while even this is of no avail if the settlement was executed within two years of the bankruptcy. The Statute of Elizabeth contains a provision by which interests lawfully acquired for good consideration and in good faith by persons having no notice of any fraud are protected. In the case *Halifax Joint Stock Banking Company v. Gledhill*, 1891, 1 Ch. 31, it was decided by the late Lord Justice Kay (then Mr. Justice Kay), after a consideration of previous cases, that this provision extends to the *purchaser* of any interest (whether legal or equitable) under the deed impeached, and prevents the deed being void *as against him* (see also *May on Fraudulent Conveyances*).

It is, of course, to be understood that, in all the preceding, the phrase “purchaser for value” means any person deriving title for *valuable* consideration (as distinguished from merely *technical* consideration), and it therefore includes not only an absolute assignee, but also a mortgagee, chargee, &c. (whether legal or equitable), and anyone claiming under an ante-nuptial settlement, since marriage constitutes valuable consideration.

On consideration of the various decisions referred to above, it would appear that (in the absence of any notice or reasonable presumption of fraud) an assurance company *bonâ fide* making a

payment under a policy (whether policy-moneys, surrender-value, or cash bonus, &c.) to a voluntary assignee, or purchasing the interest of a beneficiary under a voluntary settlement, is protected in case of the *subsequent* bankruptcy of the settlor. It would, however, seem necessary to ascertain, before concluding any such transaction, that the settlor had not *already* become bankrupt, as in that case a purchaser would apparently *not* be protected against the avoidance of the settlement, which takes place as from the date of the bankruptcy.

It must, of course, be borne in mind that the point of law cannot yet be considered to be absolutely and finally decided, as there is always the possibility that the decision of even a strong Court of Appeal may be over-ridden by the House of Lords. If in view of these considerations it is considered unsafe to purchase property of any kind from a voluntary assignee, it should be expressly stipulated, in every contract or agreement for purchase, that a title derived through a voluntary conveyance will not be accepted; for in the absence of such a condition the vendor can (on the authority of *In re Carter and Kenderdine's Contract*) force such a title on the purchaser.

It may be useful, in conclusion, to refer to one point which does not strictly fall within the scope of this note, but is nevertheless of importance in relation to purchasers of real property from voluntary assignees. Up to 28 June 1893, a voluntary conveyance of realty (but not personalty) was liable to be defeated by a subsequent sale for value by the settlor, in consequence of a decision of the Courts based upon what has been judicially called a "false and harsh construction" of the Statute 27 Eliz., c. 4. This state of things has, however, been altered by "The Voluntary Conveyances Act, 1893" (56 & 57 Vic., c. 21), which came into force on 29 June 1893, and by which it was enacted that no voluntary conveyance of lands (whether made before or after the passing of the Act) should be defeated by reason of any subsequent purchase for value *made after the passing of the Act*. In the case, however, of a voluntary conveyance of realty executed prior to 29 June 1893, there still remains the risk that the conveyance may be defeated in case of the settlor having dealt with the property for value before that date.

Since the above was written, the Courts have decided an important question which arises in relation to voluntary settlements when the settled property is a life assurance policy subject

to periodical premiums. The case in question is "*In re Harrison and Ingram*;"\* and the point in dispute was—whether a voluntary settlement not containing any covenant by the settlor for payment of future premiums on the settled policy, operates as a complete settlement of the policy-moneys *as from the date of execution of the voluntary deed*, notwithstanding that the settlor does in fact continue to pay some or all of the subsequent premiums; or whether, on the other hand, each payment of premium must be regarded as a separate and distinct voluntary settlement (either of the amount of the premium or of so much of the policy-moneys as the premium may be supposed to produce) which is liable to be set aside, under Section 47 of "The Bankruptcy Act, 1883", if the settlor become bankrupt within ten years of the date of payment of such premium. In the Queen's Bench Division, Mr. Justice Wright decided that each payment of premium constituted a separate voluntary settlement, not of the amount of the premium, but of so much of the sum assured as the premium might be supposed to have produced. This was obviously a most inconvenient decision, since, in practice, life offices do not keep a record of the persons by whom premiums are paid, nor is it easy to see how each premium can be treated as securing a certain definite part of the sum assured. It is therefore satisfactory to be able to state that the decision was over-ruled by the Court of Appeal, consisting of the Master of the Rolls (Lord Alverstone) and Lords Justices Rigby and Collins.

The following is an extract from the judgment delivered by the Master of the Rolls:

"The view taken by the learned Judge seems to have been  
"that each payment of premium secured a certain part of the  
"money assured by the policy. We cannot take this view.  
"The whole of the premiums were paid for the continuance of  
"the policy, and no proportionate part of the moneys payable  
"under the policies is represented by the payment of any  
"particular premium. Nor do we think the actual amounts  
"paid for premiums can be regarded as settlements within the  
"meaning of the 47th Section. The amounts so paid were  
"not intended to be earmarked or kept separate, nor, as we  
"have said, can they now be said to be represented by any  
"specific amount. We think the amounts must be treated as  
"paid by the bankrupt to keep up the policy as between  
"himself and the insurance company or as moneys paid to

\* This case has not yet appeared in the *Law Reports*, but was reported in *The Times* newspaper.



“ enable the trustees to keep the policy alive. For this reason  
“ we are of opinion that [*the original voluntary settlement*  
“ *having been executed more than 10 years before the bank-*  
“ *ruptcy*] the trustee of the bankrupt is not entitled to any  
“ part of the moneys paid by the insurance company, and that  
“ this appeal should be allowed.”

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*Life Assurance Legislation in Cape Colony.*

IN a previous volume of the *Journal* (xxx, 244-263), we printed in full “The Cape of Good Hope Life Assurance Act, 1891”, the 5th section of which required quinquennial valuation returns to be made in a prescribed form. An important concession has been granted under the Act, and we gladly publish the Government Notice relating thereto, given in the Cape of Good Hope Government *Gazette*, of Friday, 2 March 1900.

Many British life offices now transact business in Cape Colony, and some have, no doubt, been affected by the recent changes in the Stamp Acts. We make no apology, therefore, for publishing the following extracts from “The Stamp Acts Amendment Act, 1887”, and “The Stamps and Licences Amendment Act, 1898.” The definition of a “Joint Stock Company, as described in Section 1 of Tariff 17 of the “Schedule to Act No. 3 of 1864, as amended by Act No. 20 of “1884”, is as follows :

- “ (a) Every company having a capital stock divided into  
“ shares of which company the chief seat or principal  
“ place where its business is managed shall be within  
“ this Colony.
- “ (b) Every such company, of which the chief seat or  
“ principal place where its business is managed shall  
“ not be within this Colony, but of which any of the  
“ dealings shall, by the deed or other instrument  
“ regulating such company, be described as to be  
“ carried on in this Colony.”

The definition of a “Mutual Assurance Company”, as described in Section 10 of the same Tariff, is “a company not having a capital stock divided up into shares”; and it will be noticed that here there is no express provision that the head office of the company must be within the Colony. The Section has, however, been interpreted as though this provision were implied, and the result is that, for the purposes of tax, both proprietary and mutual companies whose head offices are outside

the Colony come under Section 11 of the Act of 1887. Section 6 of Tariff No. 1, of the Act of 1898, is apparently intended to apply only to such mutual companies as have their head offices in the Colony.

[ED. J.I.A.]

GOVERNMENT NOTICE.—No. 153, 1900.

*Treasury, Cape Town,  
Cape of Good Hope,  
28 February 1900.*

THE LIFE ASSURANCE ACT, 1891.

HIS Excellency the Governor, with the advice of the Executive Council, has been pleased, under the provisions of Section 6 of "The Life Assurance Act, 1891", to allow companies whose head offices are not situated in this Colony, to supply at their option, in lieu of the Actuarial Valuation Returns prescribed under the Fifth Schedule of Government Notice, No. 1044 of 1891, such similar Actuarial Valuation Returns as may be required under the Assurance Acts in force in the particular country where each of such head offices is situated.

HENRY DE SMIDT,  
*Assistant Treasurer.*

ACT to Amend and Explain the Law relating to Stamp Duties and Licences.

[Assented to 5th August, 1887.]

Preamble.

WHEREAS it is expedient to amend and explain in certain respects the law relating to Stamp Duties and Licences: Be it enacted by the Governor of the Cape of Good Hope, with the advice and consent of the Legislative Council and House of Assembly thereof, as follows:

Repeal of repugnant laws.

1. The several laws mentioned in the first schedule to this Act, and so much of any other law as may be repugnant to or inconsistent with the provisions of this Act, shall be and the same are hereby repealed, except as to things done, offences committed, penalties incurred, or proceedings instituted, or licences granted previously to the commencement of this Act.

Stamp duties and licences in schedule 2 established.

2. All and singular the stamp duties and licences set forth in the second schedule hereto, shall from and after the thirty-first day of December, 1887, become due and payable for and in respect of the several acts, matters and things mentioned and enumerated in the said schedule, and all and singular the several explanations, directions and provisions contained in the said schedule shall be of

the same force and effect as if the same had been contained herein, and the provisions of the 6th section of Act No. 13 of 1870 shall *mutatis mutandis* apply to all persons who should, under the provisions of this Act, or the Schedule II hereof take out and possess a licence.

11. Every insurance company, society, or association, not being such a Joint Stock Company as is described in Section 1 of Tariff 17 of the Schedule to Act No. 3 of 1864, as amended by Act No. 20 of 1884, and not being such a mutual assurance company as is referred to in section ten of the said tariff, and not now existing and carrying on business in this Colony, shall, before commencing business, take out a licence for the then current year ending the thirty-first day of December, on which licence the sum of thirty pounds sterling shall be payable; and each such company, society, or association, in respect of the second and every subsequent year during the whole or any part of which it shall carry on business, and also every such company, society, or association, which shall either now be in existence and carrying on business in this Colony, or shall be in existence, but shall have ceased to carry on or discontinued business in this Colony, in respect of every year after the 31st day of December, 1887, may commence, continue, or carry on such business, as the case may be, upon taking out a licence on which there shall be payable the sum of sixpence for every pound sterling or fraction of a pound sterling on the premiums received in this Colony, by such company, society, or association, during the preceding year ending the 31st day of December: Provided that, when the amount so calculated payable in respect of any such licence shall not amount to thirty pounds, the sum of thirty pounds and not less shall be payable in respect of every second or subsequent year, or year after the thirty-first day of December, 1887, as the case may be; and provided, further, that in no case shall a greater sum than five hundred pounds sterling be payable for the licence for any one year; and provided, further, that no such assurance company as is referred to in the tenth section of Tariff Seventeen of the Schedule to Act No. 3 of 1864, shall in any case in any one year, be bound or obliged to pay any sum by way of licence, exceeding the sum of Five Hundred Pounds sterling.

Licences of  
Insurance  
Companies  
regulated.

12. For the purpose of ascertaining the amount of licence duty chargeable for the second and every subsequent year under the provisions of the last preceding section, every insurance company, society, and association shall, by its manager, secretary, or agent, make a return in writing, in such form as the Governor may prescribe, setting forth the amount of premiums received by such company, society, or association at its head office and at

Return to be  
rendered for  
purpose of  
determining  
amount of  
licence to be  
paid by  
Insurance  
Company.

all its branch offices, in the Colony during the year ending the 31st day of December preceding such return, and such return shall be made to the officer appointed by the Governor in that behalf on or before the 15th January in each year. Any company, society, or association making a false return, or neglecting or refusing to make a return, shall be liable to a penalty not exceeding one hundred pounds, and such penalty shall be recoverable from the manager, secretary, or agent of any such company, society, or association in any competent court: Provided that the affixing of any sign-board or door-plate at the place of business of the said manager, secretary, or agent of any such company, society, or association, or the issue of any advertisement in a public print, or of any prospectus advertising business for such company, society, or association shall be considered sufficient proof that business is being carried on by the said manager, secretary, or agent on behalf of such company, society, or association: Provided also that any company, society, or association which shall tender the sum of five hundred pounds for its licence for any one year shall not be required to make any such return in respect of that year.

Deposits of  
£10,000  
required from  
English,  
Colonial, or  
Foreign  
Companies.

14. Every Assurance Company, whose head office or place of business is or shall not be situated within this Colony, either now established or carrying on business or hereafter becoming established and commencing to carry on business, within this Colony, managed or represented either by a board, secretary, manager or agent, and which either before the passing of this Act has carried on or thereafter shall commence to carry on the business of Fire, Marine, Accident or Life Assurance in this Colony, if such company shall after the passing of this Act continue or commence to carry on such business in the Colony, shall be and is hereby required to deposit, on or before the first day of January in the year succeeding that in which it shall so continue or commence to carry on such business, with the Treasurer-General of this Colony, to his satisfaction, securities to the value of ten thousand pounds sterling; provided, however, that the income derived from such securities may be received by the depositor.

Provision for  
substitution  
of securities.

15. Any company may, on giving due notice to the Treasurer-General, withdraw from his custody any securities so deposited, on depositing with him securities of an equal value, and any substituted securities shall for all purposes be treated as securities originally deposited.

## SCHEDULE I.

## ENACTMENTS REPEALED.

No. and Year	Title	Extent of Repeal
Act No. 3 of 1864	"The Stamp Act, 1864"	Section 22, Tariff 6, and Sections 5, 7 and 9 of Tariff 17 of the Schedule,
Act No. 20 of 1884	"The Stamp and Office Fees Act, 1884."	In Tariff 15 of Schedule 2, the items "For Dealing by Wholesale, £15", "For Dealing by Retail, £3", and Section 7.
Act No. 28 of 1883	"The Liquor Licensing Act, 1883."	In the Second Schedule the words "to endure for one year from the date of issue thereof", occurring between the words "For a Wholesale Licence", and the words "Thirty Pounds."

Act to Amend the Law relating to Licences and Stamps.

[Assented to 23rd December, 1898.]

BE it enacted by the Governor of the Cape of Good Hope, with the advice and consent of the Legislative Council and House of Assembly thereof, as follows:—

1. The several laws mentioned in the first Schedule to this Act, to the extent therein stated, and so much of any other law as may be repugnant to or inconsistent with the provisions of this Act, shall be and the same are hereby repealed except as to things done, offences committed, penalties incurred, or proceedings instituted before the taking effect of this Act.

2. All and singular the several provisions, directions, explanations, conditions and definitions contained in Tariffs No. 1 and No. 2, in the second Schedule hereto, shall be of the same force and effect as if the same had been contained in one or more of the enacting clauses of this Act.

3. All and singular the fees of office set forth in the Tariffs Nos. 3, 4 and 5, in the second Schedule hereto shall, from and after the taking effect of this Act, become due and payable in civil cases for, and in respect of, the several instruments, documents and processes enumerated in the said tariffs.

Preamble.

Repeal of Laws.

Provisions of Tariffs 1 and 2 in Schedule 2 shall have effect as Law.

Fees of office set forth in Tariffs 3, 4 and 5 of 2nd Schedule to become payable.



## SCHEDULE I.

## ENACTMENTS REPEALED.

No. and Year	Title	Extent of Repeal
No. 3 of 1864 ...	"The Stamp Act, 1864."	So much of Tariff 17 of the Schedule as has not been already repealed.
Act No. 20 of 1884	"The Stamp and Office Fees Act, 1884."	In Schedule 2, Tariff 16, the items:— "Every Scrip Certifi- "cate, Scrip or Share "(new Scrip Certifi- "ates without change "of proprietorship "excepted)— "(a) Entitling any "person to become "the proprietor of "any share in any "Company or pro- "posed Company, "(b) Issued or deliver- "ed in the Colony "and entitling any "person to become "the proprietor of "any share in any "Colonial or For- "eign Company or "proposed Com- "pany— "For every £10 of sub- "scribed Capital or "fraction thereof £0 0 3 "Every transfer of "any such share— "For every £10 of sub- "scribed Capital or "fraction thereof £0 0 1
No. 15 of 1877 ...	"The Stamp Act, 1877."	The Schedule thereto.
No. 20 of 1884 ...	"The Stamp Act and Office Fees Act, 1884."	Tariff III in Schedule. Fees in Civil Cases in the Court of Appeal, the Supreme Court, the Court of the Eastern Districts, the High Court of Griqualand and the Circuit Courts.
Proclamation No. 2, B.B., 6th October, 1885.	Laws and Regulations for the Government of British Bechuanaland.	Regulation No. 45.

The Rule of the Supreme Court No. 308, promulgated by Government Notice dated the 3rd January, 1878, relating to Fees to be taken by the Clerk of the Court of the Resident Magistrate.

The Rule of the Supreme Court No. 359, promulgated by Government Notice dated the 25th July, 1884, relating to the Fees to be taken in connection with the sale of real property under attachment.

## SCHEDULE II.

### TARIFF NO. 1.

#### *Annual Joint Stock Companies.*

Every joint stock company carrying on business in this Colony shall annually take out a licence, for which there shall be payable for every £100 or fraction of £100 of the subscribed capital of such company... .. £0 1 0

1. The term "joint stock company" shall, for the purpose of the above licence be taken to mean:

- (a) Every company having a capital stock divided into shares, of which the chief seat or principal place where its business is managed shall be within this Colony.
- (b) Every such company of which the chief seat or principal place where its business is managed shall not be in this Colony, but of which any of the dealings or business of such company shall be carried on within this Colony, either by directors appointed to carry on such dealings or business or by a managing director, manager, secretary or agent on behalf of such company: Provided that when the only business carried on by any company in this Colony shall be the registration of transfers of shares in the said company, such company shall annually take out a licence for which there shall be paid the sum of £5 in lieu of the aforesaid licence: Provided further that nothing herein contained shall in any way alter or affect or apply to the licences of such companies as are regulated by sections 11 or 12 of the Act 38 of 1887.

2. The licence issued to any such company at any seat or place of business thereof in his Colony shall cover the business of such company as a joint stock company at all its places of business in this Colony.

3. The above licence shall, no matter at what period of the year the same may have been taken out, expire on the 31st of December then next ensuing. When any such licence shall be issued upon or after the first day of July there shall be payable only one-half of the amount calculated as herein directed; if taken out before the first day of July there shall be no deduction.

4. The directors for the time being within this Colony of any such company as aforesaid shall be personally liable *singuli in solidum*

for the amount payable for the licence. If there be no directors within this Colony, but only a managing director, manager, secretary or agent, then such managing director, manager, secretary or agent shall be liable.

5. Before a licence is taken out by any such company and on every renewal of a licence there shall be delivered to the officer appointed to issue such licence a certificate of the subscribed capital or such company. Such certificate shall be signed by a director, if there be one, or managing director, manager, secretary or agent of such company; in the event of the neglect or refusal of any such director, managing director, manager, secretary or agent to certify such amount the officer aforesaid shall be entitled to estimate the subscribed capital of such company at whatever amount he shall from the information within his reach, judge to be sufficient, and calculate the sum payable for a licence according to such amount, and such amount shall be recovered as aforesaid.

6. Every mutual assurance company, not having a capital stock divided into shares, and every building society, whether one having a capital stock divided into shares or not, shall annually take out a licence for which there shall be payable the sum of one shilling for every £100 or fraction of £100 of the accumulated fund of such company, as such fund shall have been ascertained by the latest statement of accounts laid before its members at any general meeting thereof: Provided that no such company or society as is in this clause mentioned, of which the accumulated fund for the time being shall be less than £10,000, shall be required to take out a licence under this Act: Provided, further, that before the issue or renewal of any such licence a duly certified copy of such latest statement of accounts, to be rendered in such form as the Governor may from time to time fix, shall be delivered to the officer appointed to issue such licence; and provided also that no such company or society shall in any case in any one year be bound or obliged to pay any sum by way of licence exceeding the sum of five hundred pounds sterling.

7. Nothing in this Act contained shall require any savings bank society or benefit society to take out any licence.

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## THE INSTITUTE OF ACTUARIES.

### EXAMINATIONS OF THE INSTITUTE, APRIL 1900.

#### EXAMINATION FOR ADMISSION TO THE CLASS OF ASSOCIATE (PART I).

*Examiner*—PROF. S. L. LONEY, M.A.

*Supervisors*—MESSRS. F. E. COLENZO, M.A., and J. E. FAULKS, B.A.

#### *First Paper.*

1. A man invested £1,874. 8s. in  $2\frac{3}{4}$  per-cent Consols at  $98\frac{7}{8}$ ; how much money must he invest in a  $3\frac{1}{2}$  per-cent Stock at  $104\frac{7}{8}$ , so that the rate of interest on his whole investment may be 3 per-cent?

[Brokerage  $\frac{1}{8}$  per-cent in each case.]

2. If 
$$\frac{b-c}{y-z} + \frac{c-a}{z-x} + \frac{a-b}{x-y} = 0,$$

prove that  $(b-c)(y-z)^2 + (c-a)(z-x)^2 + (a-b)(x-y)^2 = 0$ .

3. Find the condition that the roots of the equation  $ax^2 + bx + c = 0$  may be real and different.

If  $x$  be real, find the limits between which the expression  $\frac{x^2 - 6x + 25}{x^2 + 6x + 25}$  must lie.

4. Find the number of combinations of  $n$  things, taken  $r$  at a time, without assuming the formula for permutations.

How many words can be made by using all the letters in the word *Abacadabracadabra*?

5. Assuming the truth of the Binomial Theorem for a positive integral exponent, prove its truth for a negative or fractional exponent, stating the necessary limitations in the value of any symbol employed.

If  $x$  be so small that its square may be neglected, prove that 
$$\frac{\sqrt{1+2x} \times \sqrt[4]{16+3x}}{(1-x)^2} = 2 + \frac{195}{32}x.$$

6. Define a logarithm, and show that  $\log_a m^n = n \log_a m$ , and that  $\log_a m = \log_b m \times \log_a b$ .

Solve the equation  $2^x = 35$ , correct to five places of decimals, given that  $\log 28 = 1.4471580$  and  $\log 4.9 = .6901960$ .

7. State, and prove the truth of, the Exponential Theorem.

Show that

$$\frac{e-1}{e+1} = \left\{ \frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \dots \text{ad inf.} \right\} \div \left\{ \frac{1}{1} + \frac{1}{3} + \frac{1}{5} + \dots \text{ad inf.} \right\}.$$

8. Resolve  $\frac{x^2 + px + q}{(x-a)(x-b)(x-c)}$  into partial fractions.

Show that the coefficient of  $x^n$  in the expansion of  $[(1-x)(1-cx)(1-c^2x)]^{-1}$  is  $\frac{(1-c^{n+2})(1-c^{n+1})}{(1-c^2)(1-c)}.$

9. By the method of Differences, or otherwise, find the  $n$ th term, and the sum of  $n$  terms, of the series  $4 + 5 + 8 + 15 + 30 + 61 + \dots$

10. An event must have happened from one of  $n$  mutually exclusive causes, the antecedent probabilities of which are  $P_1, P_2, \dots P_n$  respectively; the probabilities that when these causes exist the event happens are respectively  $p_1, p_2, \dots p_n$ . Show that on any occasion on which the event happens, the probability that it was due to the  $r$ th cause is 
$$\frac{P_r \cdot p_r}{P_1 \cdot p_1 + P_2 \cdot p_2 + \dots + P_n \cdot p_n}.$$

A purse contains five coins, each of which is equally likely to be a sovereign or a shilling and cannot be anything else; two of

these coins are drawn at random and found to be sovereigns. Show that the fair price to offer for the purse is £3. 11s. 6d.

11. Find the value of  $\Delta^n u_x$ , where  $u_x$  is equal to

$$(1) a^x,$$

and

$$(2) x(x-1)(x-2) \dots (x-m+1).$$

If  $u_x$  be a rational integral function of the  $n$ th degree in  $x$ , prove that its  $n$ th difference is constant.

12. Explain what is meant by Interpolation, as applied to the calculation of Tables, and show how to find a missing term in a series of equidistant terms.

Find  $u_2$ , given that  $u_0=98,203$ ,  $u_1=97,843$ ,  $u_3=97,034$ , and  $u_4=96,569$ .

### Second Paper.

13. The cost of levelling and turfing a square cricket field, at £175. 9s. 4d. per acre, is £987; find the cost of surrounding it with a railing at 3s. 2d. per yard.

14. Simplify the expression 
$$\frac{(x+a)^3 + (x+b)^3 - (2x+a+b)^3}{(x+a)(x+b)(2x+a+b)}$$

Find the square root of  $26-7\sqrt{3}$ .

15. Solve the equations:

$$(1) \frac{x+4}{x+3} - \frac{x-2}{x-1} = \frac{4}{15};$$

$$(2) (x+1)(x+5)(x+9)(x+13)=105;$$

$$(3) \begin{cases} x^4 + x^2 y^2 + y^4 = 133, \\ x^2 - xy + y^2 = 19. \end{cases}$$

16. A train travelling at the rate of 30 miles per hour starts from a town A to a town B; 12 minutes later a second train travelling at 40 miles per hour starts from B to A, and goes half a mile beyond the middle point between A and B before it meets the first train; find the distance between A and B.

17. Find the sum of the squares of the first  $n$  natural numbers.

Prove that the difference between the square of the arithmetical mean of the  $n$  quantities  $a+x$ ,  $b+x$ ,  $c+x$ , ... and the arithmetical mean of their squares is the same whatever be the value of  $x$ .

18. If  $(1+x)^n = c_0 + c_1 x + c_2 x^2 + \dots + c_n x^n$ , find the value of  $c_0^2 + c_1^2 + c_2^2 + \dots + c_n^2$ .

Find the coefficient of  $x^r$  in the expansion of  $\frac{(1-x)^n}{(1+x)^3}$ , where  $n$  and  $r$  are positive integers and  $r > n$ .



19. Find the value of  $(34782)^{\frac{1}{2}} \times (289)^{\frac{2}{3}}$ , given  $\log 3478 = 3.5413296$ ,  $\log 3479 = 3.5414544$ ,  $\log 17 = 1.2304489$ , and  $\log 35389 = 4.548869$ .

20. Find the generating function, and the general term, of the recurring series  $1 - 5x - 23x^2 - 77x^3 - \dots$ .

Sum the series  $2.5 + 3.6 + 4.7 + \dots$  to  $n$  terms.

21. Show that the probability that two independent events should both happen is the product of the separate probabilities of their happening.

A throws twice with a cubical die whose faces are numbered from 1 to 6, and B throws four times with a counter marked 1 on one side and 6 on the other; find the chance that the sum of the numbers thrown by B shall be double the sum of those thrown by A.

22. Three black balls and five white ones are placed in a bag; three men draw in succession (the drawn ball being continually replaced before the next drawing) until a black ball is drawn; prove that their respective chances of success are as 64:40:25. If the drawn ball be not replaced, show that their respective chances are as 27:18:11.

23. Prove the formula

$$u_n = u_0 + n \cdot \Delta u_0 + \frac{n(n-1)}{1 \cdot 2} \cdot \Delta^2 u_0 + \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3} \cdot \Delta^3 u_0 + \dots$$

Given  $u_0 = 72,795$ ,  $u_1 = 71,651$ ,  $u_2 = 70,458$ , and  $u_3 = 69,215$ , find the value of  $u_{10}$ .

24. If  $u_x = ax + b$ , prove that

$$\Sigma \frac{1}{u_x u_{x+1} u_{x+2} \dots u_{x+n-1}} = C - \frac{1}{a(n-1) u_x u_{x+1} \dots u_{x+n-2}},$$

where  $C$  is a constant.

Find the sum of the series  $\frac{1}{1.5.9} + \frac{1}{5.9.13} + \frac{1}{9.13.17} + \dots$  to  $n$  terms.

# EXAMINATION FOR ADMISSION TO THE CLASS OF ASSOCIATE (PART II).

*Examiners*—MESSRS. B. A. BERRY, A. D. BESANT, A. E. MOLYNEUX,  
and W. O. NASH.

## *First Paper.*

1. Give a verbal description of each of the four quantities  $i$ ,  $v$ ,  $d$ ,  $\delta$ ; and deduce four equations expressing their relations to one another.

$$\text{Show that } \delta = \frac{i+d}{2} - \frac{i^2-d^2}{4} + \frac{i^3+d^3}{6} - \dots$$

2. What are the functions usually tabulated in sets of Interest Tables?

Describe briefly the methods of computation and the checks for ensuring accuracy that you would adopt.

3. Having values of  $l_x$  for all ages, it is desired to obtain Tables of  $D_x$ ,  $N_x$ ,  $a_x$ , and their logarithms. Describe fully the processes you would follow in constructing and verifying these Tables.

4. Of three lives  $(x)$ ,  $(y)$ , and  $(z)$ , find the probabilities

(a) that one only will survive  $n$  years,

(b) that one at least will survive  $n$  years.

When are these probabilities said to be expressed in their lowest terms, and what is the object aimed at in so expressing them?

5. Express verbally and in Commutation symbols  $a_x^{(t)}$ ,  $a_{y|x}$ ,  $\dot{a}_{y|x}$ .

6. Given

(a) a scale of net annual premiums for endowments on the lives of children, with return of premiums paid in the event of death before the endowment matures,

(b) a scale of net whole-life annual premiums, and

(c) a table of life annuities,

deduce a level annual premium for a deferred whole-life assurance for a child aged 2, the assurance to commence on attainment of age 21, and all premiums paid to be returned in the event of death before that age.

7. Find the single and annual premiums for an assurance of £1, payable only in the event of  $(x)$  dying within  $t$  years, and provided that  $(y)$  is alive at the moment of the death of  $(x)$ .

8. What is the meaning of the words "the Value of a Policy"?

Deduce from first principles the net value of a whole-life Policy, in force  $n$  years, by the retrospective and prospective methods, and show the identity of the two expressions.

Prove, and give a verbal interpretation of, the identity  ${}_nV_x + P_x = v\{q_{x+n} + p_{x+n} \cdot {}_{n+1}V_x\}$ .

9. Deduce formulas for employing a Cash Bonus

(a) to convert a whole-life Policy into an Endowment Assurance,

(b) to limit the number of future premiums payable.

10. Define accurately the meaning of each of the symbols in the following expressions:

$$(a) \quad \frac{d_x}{E_x} = q_x$$

$$(b) \quad l_x \times q_x = d_x$$

11. Enumerate and discuss the principal classes of securities (exclusive of Life Interests and Reversions) now held by British Life Assurance Companies.

How has the fall, during recent years, in the rate of interest modified the position as regards fresh investments? State how you would invest surplus funds amounting to £100,000 per annum, giving the approximate yield of the securities you name.

12. In what circumstances can a claim under a Life Policy be successfully resisted on the ground of inaccuracies in the statements made by the assured prior to its issue?

Discuss (a) the nature of the inaccurate statements,

(b) the wording of the Policy,

(c) the period of the discovery of the inaccuracies by the Office.

### *Second Paper.*

*[A short collection of Actuarial Tables will be supplied, and should be used in answering Questions 13, 14 and 15.]*

13. A loan having been made for  $t$  years certain at interest  $i$  payable yearly, determine an expression for the compensation to be paid on repayment of the balance at the end of  $t-n$  years, it being agreed that money can only be reinvested at interest  $i'$ ;

(a) When the yearly repayment of the principal is  $\frac{1}{t}$ th of the loan,

(b) When the loan is repaid by an equal yearly annuity.

A borrower of £5,000, at 4 per-cent interest payable yearly, has contracted to repay by 25 yearly instalments of £200 each. At the end of 10 years he desires to redeem the security. Determine the compensation to be paid on the basis that money can only be reinvested at  $2\frac{1}{2}$  per-cent.

14. Fifteen £1,000 Bonds, bearing interest at 6 per-cent payable 1 January and 1 July, were bought for a Life Office on 1 April last at  $117\frac{1}{2}$  per-cent, the brokerage being 5s. per-cent. The Bonds are repayable on 1 July 1919 at 110 per-cent. Determine practically, for Office purposes, the principal invested (to the nearest pound) and the approximate rate of interest realized.

Explain how income from the Bonds should be kept separate from capital in the Office Books.

15. Find the office annual premium required for a whole-life assurance of £100 on a life aged 30, making allowance for a reduction of 50 per-cent in the premium after seven years, and for expenses amounting to half the office premium in the first year, and to 5s. per annum subsequently.

16. Explain verbally the meaning of the expression  $\frac{N_{x-n}}{D_x}$ .

17. Express the "central death rate" in terms of the columns  $d$  and  $l$  of a Mortality Table; and express  $p_x$  and  $q_x$  in terms of the "central death rate" for age  $x$ .

18. Find the annual premium for an annuity payable to  $(x)$  after the death of  $(y)$ , the premiums paid to be returned, without interest, in the event of  $(x)$  predeceasing  $(y)$ .

19. Give Simpson's Rule for finding the approximate value of an annuity on three joint lives. Explain the nature of the error thereby introduced, and mention the various adjustments which have been suggested for correcting it.

20. State and prove the rule for utilizing a Conversion Table to find the single and annual premiums for an Endowment Assurance.

21. The Mortality Experience of a Life Office, from its foundation, is to be investigated on the "Policy Year" method. State, with reasons, how you would tabulate

(a) The entrants,

(b) The numbers passing out of observation by death, withdrawal, and existence respectively.

Give the appropriate formulas expressing  $E_{[x]+t}$  (select) and  $E_{x+t}$  (aggregate) in terms of  $n$ ,  $d$ ,  $w$ , and  $e$ , with suffixes.

22. Give your opinion of the various classes of leasehold property which are offered to Life Offices as security for loans; and state, regarding each class that you consider acceptable, the points on which information should be sought, and the precautions that should be taken, before a loan is made.

23. "Statutory notice" is a common expression as between policy-holder and Life Office. To what Act does it refer? Draw up a statutory notice that A has assigned, by way of mortgage, a Life Policy to B. What steps should be taken by the Office on receipt of the notice?

To what extent does priority of notice determine priority of title?

24. The sum assured by a Life Policy has become payable to the Trustees of a Marriage Settlement. How can the money pass without involving the Office in any risk?

What variation in the law respecting payment to Trustees has taken place in recent years?

EXAMINATION FOR ADMISSION TO THE CLASS OF FELLOW  
(PART III, SECTION A).

*Examiners*—MESSRS. GEOFFREY MARKS, T. G. ACKLAND, H. W. ANDRAS,  
L. F. HOVIL, G. J. LIDSTONE, and H. E. NIGHTINGALE.

*First Paper.*

1. State the nature and legal consequences of the following:—

- (a) Receiving order in bankruptcy.
- (b) Adjudication in bankruptcy.
- (c) Order for summary administration in bankruptcy.
- (d) Order of discharge in bankruptcy.

Your company has received informal notice that A. B., the assured by one of its life policies, has been adjudged bankrupt. The assured subsequently receives his discharge, and applies for the surrender-value of his policy, producing the policy itself, and office copies of the adjudication and the order of discharge. What would be your requirements in connection with the proposed surrender?

2. State whose discharge you would require for the moneys payable under a trust policy effected by a man for the benefit of his wife and children—

- (a) Under the Married Women's Property Act, 1870;
- (b) Under the Married Women's Property Act, 1882;

and state clearly your authority in each case.

3. What are the main differences in law between real and personal property; and how far have the two been assimilated by recent legislation?

4. Explain what is known as the "arbitrated par of exchange" between two countries. State approximately the present rates of exchange on London, in Paris, Berlin, New York, Vienna, and Amsterdam.

5. State what steps the government of India is taking to establish the currency upon a firm basis, and discuss the prospects of this end being attained by these or other means.

6. To what causes do you ascribe the difference in value between the imports and exports of Great Britain?

7. Given the values  $u_{20}$ ,  $u_{23}$ ,  $u_{30}$ ,  $u_{35}$ ,  $u_{45}$ ,  $u_{55}$ , show how you would interpolate for  $u_{40}$ .

8. Given the following table of prospectus rates, deduce the annual premium for an assurance on the joint life of two persons aged 27 and 34:—

Ages		Annual Premium	Ages		Annual Premium
20	20	£3 2 0	25	30	£3 13 9
20	25	3 5 3	25	35	3 19 1
20	30	3 11 1	30	30	3 18 8
20	35	3 16 11	30	35	4 2 10
25	25	3 10 0	35	35	4 11 0



9. Deduce, by methods of finite differences, the value of  $Q_{x|y}^1$ , the probability of ( $x$ ) dying before ( $y$ ).

10. State briefly the methods followed in the construction and graduation of the tables representing the mortality of lives assured (A F) and of annuitants (R F) in France, and discuss the merits or demerits of the methods severally adopted.

11. State some of the methods which have been suggested for applying Woolhouse's formula of graduation in columnar form. Which method would you select as giving the results with greatest facility, having due regard to verification?

12. In the Registrar-General's report for 1897, the mean annual mortality per-cent of publicans is stated as follows:

Ages	20-24	25-34	35-44	45-54	55-64	65 & upwards
Mortality	·869	1·521	2·332	3·484	5·318	10·567

From these data show how you would derive the net annual premium required, at age 30, for the assurance of 1 at death.

### *Second Paper.*

13. State how the law applying to registered friendly societies differs from that relating to ordinary life assurance companies in respect of

- (a) Powers of investment.
- (b) Transfer of member's (or policyholder's) interest at death.
- (c) Insurable interest.
- (d) Stamp duties and taxation.

14. State generally the contents of the memorandum and articles of association of a company registered under the Companies Acts. How can alterations be legally effected in (a) the memorandum, and (b) the articles of association?

15. In what respects do you consider that the provisions and schedules of the Life Assurance Companies Acts 1870 to 1872 could be usefully amended, having regard to the modern conditions of life assurance in the United Kingdom?

16. State briefly the chief provisions of the Bank Act of 1844, and the main objects which its framers had in view.

17. What do you understand by "Local Loans Stock", in the official list of the Stock Exchange? Give some account of the circumstances under which this stock was created, and the effects of such creation.

18. Explain how it is that the condition of the money market exercises so powerful an influence upon the prices of Stock Exchange securities.

19. Show how to find the sum of a series of equidistant values of any rational integral function of  $x$ .

Find an expression for  $u_x$  in terms of ascending powers of  $x$ , where  $S_5=1,100$ ,  $S_{10}=12,275$ ,  $S_{15}=48,200$ ,  $S_{20}=123,875$ ;  $\Delta^3$  being constant; and  $S_n=u_1+u_2+\dots+u_n$ .

20. Express  $u_x$  in terms of  $u_0$  and the difference-functions  $\Delta u_0$ ,  $\frac{1}{2}\Delta^2(u_0+u_{-n})$ ,  $\Delta^3 u_{-n}$ , &c., derived from the functions  $\dots u_{-2n}$ ,  $u_{-n}$ ,  $u_0$ ,  $u_n$ ,  $u_{2n}\dots$

21. Show that, if  $u_x$  is a rational integral function of  $x$  of the  $n$ th degree, and is of the form  $Ax^n+Bx^{n-1}+Cx^{n-2}+\dots$ , then, if  $r < n$ ,  $\Delta^r u_x$  is a function of  $x$  of degree  $n-r$ , in which the term involving  $x^{n-r}$  is

$$A.n(n-1)(n-2)\dots(n-r+1)x^{n-r}h^r,$$

where  $h=\Delta x$ .

To what does  $\Delta^r u_x$  reduce when  $r=n$ , and when  $r > n$ , respectively?

22. In investigating the mortality experience of lives under endowment assurance policies in an office (or group of offices) where some of the assurances mature on a birthday, and others on a policy-anniversary, what special methods would you adopt in deducing the "exposed to risk" for such matured cases respectively, having due regard to the incidence of the cases in policy-years?

23. State clearly the methods adopted in the graduation of the  $H^M$  table upon Makeham's hypothesis, as tabulated in the Institute of Actuaries' Text-Book. What special modification was introduced in the early years of life, and how does this modification affect the utility of the graduated table for the convenient calculation of the values of joint-life annuities?

24. Show that the average magnitude (irrespective of sign) of the deviations between the actual and expected deaths in a year amongst  $N$  lives aged  $x$  at the beginning of the year, may be approximately represented, when  $N$  is large, by the expression

$$\cdot 8 \sqrt{N \cdot p_x(1-p_x)}$$

$p_x$  being the true probability of each life surviving the year. You may assume that, when  $t$  is great,  $|t| = \sqrt{2\pi} \cdot t^{t+\frac{1}{2}} e^{-t}$  nearly; where  $\pi=3.14\dots$

EXAMINATION FOR ADMISSION TO THE CLASS OF FELLOW  
(PART III, SECTION B).

*Examiners*—MESSRS. GEOFFREY MARKS, T. G. ACKLAND, H. W. ANDRAS,  
L. F. HOVIL, G. J. LIDSTONE, and H. E. NIGHTINGALE.

*First Paper.*

1. What methods would you suggest for

- (a) Framing a table of premiums for sinking fund assurances.
- (b) The valuation of such contracts.

2. Describe and give your opinion of Herr Altenburger's method of valuing policies in groups, as applied to whole-life limited payment policies.

If the valuation ages are assumed to be the nearest integral ages on the date of valuation, and the policy anniversaries fall, on the average, 8 months after the date of valuation, state precisely what formulæ you would adopt in calculating the auxiliary constants.

3. A life assurance company has largely increased its new business during the past few years, and realizes interest on its Funds at the average net rate of £3. 15s. per-cent per annum. A Valuation just completed on an  $H^M$  3 per-cent pure premium basis shows that the surplus derived from ordinary sources during the past quinquennium is sufficient to provide for a compound reversionary bonus of 30s. per-cent per annum (the rate declared for many years past), and that there is in addition a special surplus derived from abnormal sources. It has been decided not to increase the rate of bonus, and you are asked to advise as to the relative advantages and disadvantages of the following ways of dealing with the special surplus—

- (a) Passing to an  $H^M$  and  $H^{M(5)}$  3 per-cent valuation.
- (b) Passing to an  $H^M$   $2\frac{3}{4}$  per-cent valuation.
- (c) Carrying the amount forward as a special reserve.

Draft a report, assuming that the extra reserves required for (a) and (b) are both approximately equal to the special surplus.

4. What channels are open to a life office for the temporary investment of its surplus balances? Give your opinion of the desirability of those you mention.

What are "Lloyd's Bonds", and what do you think of them as an investment for a life office?

5. State the various methods of valuing Stock Exchange securities in the balance-sheets of life assurance companies, and the advantages and disadvantages of each. Which would you prefer, and for what reason?

6. A aged 30 is entitled to a reversionary life interest of £1,000 a year, commencing at the death of B, should B aged 60 (having a wife living aged 55, but no issue) predecease him leaving no issue.

Calculate the market value of A's interest assuming a reasonable single premium for the issue risk, and state how you would estimate such single premium in practice.

7. Upon what basis as to mortality and interest, and with what loading for commission, expenses, &c., would you calculate office premiums for the following benefits:

Whole life assurances, without profits.

Endowment assurances, with and without profits,

Whole life discounted bonus assurances,

the bonus being distributed as a percentage on the sum assured for each year a policy is in force during a quinquennium?

8. You are asked to ascertain what percentage of the salaries of officials would suffice to provide pensions on retirement at a given age, such pensions to be two-thirds of a man's average salary for the five years immediately preceding retirement. What data would you require for the purpose of your calculation, and how would you make it?

9. How would you proceed to find the net single and annual premium for a term assurance of £100 payable in the event of the survivor of four healthy lives aged 20, 25, 30, and 35 years dying within 10 years from the present time?

What office premiums would you quote in practice?

10. Write down the value of  $l_x$ , according to Makeham's *second* development of Gompertz' hypothesis; thence deduce the value of  $\mu_x$ , and show clearly under what conditions the "law of uniform seniority" is applicable under this second development.

11. Find the value of  $a_{\overline{xxx} \dots (m)}^{\overline{r}}$  and  $a_{\overline{xxx} \dots (m)}^{[r]}$  in terms of ordinary joint-life annuities.

Show how to deduce, by considerations of symmetry, the corresponding expressions when the  $m$  lives are all of different ages.

12. A table, giving for each integral age the force of mortality according to the formula  $\mu_x = A + Bc^x$ , is entered inversely with a value  $\mu$  lying between  $\mu_y$  and  $\mu_{y+1}$ , and the age to which the value  $\mu$  corresponds is determined approximately by the ordinary method of proportional parts to be  $y + a$ . If the *true* age be  $y + \beta$ , establish the following results:

(a) The maximum value of  $\beta - a$  will be

$$\frac{1}{\log_e c} \left[ \log_e \left( \frac{c-1}{\log_e c} \right) - 1 \right] + \frac{1}{c-1},$$

$$\text{which will occur when } a = \frac{1}{\log_e c} - \frac{1}{c-1}.$$

(b) The *mean* value of  $\beta - a$ , if all values of  $\beta$  between 0 and 1 be equally probable, will be  $\frac{1}{2} + \frac{1}{c-1} - \frac{1}{\log_e c}$ .

*Second Paper.*

13. On what basis as regards

- (a) Rate of interest,
- (b) Rate of mortality,
- (c) Reserve of loading,

would you calculate the reserves of a well-established industrial assurance company?

In what special way, if any, would you deal with assurances on the lives of young children, and why?

14. Discuss the question whether a company which adopts the pure premium method of valuation should calculate the premiums for valuation according to age *next* birthday or age *nearest* birthday at entry, and state whether, and in what way, the answer in your opinion depends upon (a) the rate of interest assumed in the valuation, (b) the proportion of annual new business to existing business.

Having given a valuation summary in the form prescribed in the 5th schedule to "The Life Assurance Companies Act, 1870", how would you make a rough estimate of the difference between the reserves produced by the two methods of calculating the premiums mentioned above?

15. What are the chief sources of profit in a life assurance company, and how would you analyze the total valuation profit, in order to ascertain the amount derived from each source?

State briefly how you would apportion the surplus from each source among the policyholders.

16. A life assurance company holds 5 per-cent currency bonds of an American railway company, redeemable at 110 in 1920. The railway company proposes to convert the bonds into  $3\frac{1}{2}$  per-cent gold bonds (redeemable in 1950 at par), on the basis of a fixed amount of  $3\frac{1}{2}$  per-cent bonds for each \$1,000 of the 5 per-cent bonds. What points would you specially consider, and how would you proceed, in forming an opinion as to the desirability of agreeing to the conversion?

17. Draft forms of proposal calculated to elicit all the preliminary information necessary for the due consideration of the following transactions:—

- (a) Loan on or sale of a life interest or reversionary interest,
- and (b) Loan on mortgage of freehold or leasehold property.

18. Discuss the general question whether it is advisable for a sound office to take over the liabilities and assets of an insolvent life office.

In advising on the terms on which such a transfer should be effected, to what points would you specially direct attention, assuming the insolvent office to be (a) mutual, (b) proprietary?



19. A, aged 35, is entitled under a voluntary settlement to the reversion, contingent on his surviving a lady, aged 60, to the following Fund :—

£3,000 Consols.

£4,000 L. & N. W. Ry. Co. 3 per cent. Debenture Stock.

£2,000 on mortgage.

Freehold property in the City of London. let on lease at £120 per annum.

Value this reversion, stating what preliminary enquiries you would make (*a*) as to title, (*b*) as to the fund.

20. A lady, aged 50, and her husband, aged 52, are entitled to successive life interests in an Estate valued at £10,000, and producing £300 per annum. At the death of both parents the estate is to be divided equally between the survivors of all the children of the marriage. There are now 7 children alive aged 18, 23, 24, 26, 28, 31, and 32, and the father proposes to join with the 6 adult children in raising a loan on their combined interests in the estate.

How would you proceed to find the maximum amount that could be advanced on the security?

21. Write down the integral expressing the value of an annuity to (*u*), to commence on the death of (*w*), if (*x*) die before (*w*), and (*y*) before (*x*), and (*z*) before (*y*); and state which formula of approximate summation you would select for facility of computation, and how you would arrange the work of evaluation in columnar form.

22. If the force of interest is originally  $\delta_0$ , and varies continuously so that  $\frac{d}{dt} \delta_t = -\alpha \log_e r \cdot r^{-t}$  (where  $\delta_t$  denotes the force of interest after *t* years), find the present value of 1 due *n* years hence.

$$\begin{aligned} \text{Assuming} \quad \delta_0 &= \cdot 035 \\ \alpha &= \cdot 0005 \\ r &= 1\cdot 05 \\ \log_e r &= \cdot 04879 \end{aligned}$$

apply a formula of approximate summation to find the value of  $a_{\overline{20}|}$ .

23. Show that, if a mortality table follows Makeham's law, then  $a_{x|yz} \dots (g)$ , calculated at rate of interest *i*, is equal to  $a_{w|vw} \dots (h)$ , calculated at rate  $i + \theta$ , and find the values of *w* and  $\theta$ .

Calculate the value of  $a_{30, 40, 50, 55, 60, 65}$ , according to the *Text-Book* Tables at 3 per-cent interest.

24. Assuming the following formula,

$$\begin{aligned} & \frac{1}{m} \left[ u_t + u_{\frac{1}{m}+t} + \dots + u_{\frac{mn-1}{m}+t} \right] \\ &= \int_0^n u_x dx + \left( \frac{1}{2m} - t \right) (u_0 - u_n) \\ & \quad - \frac{1-6mt+6m^2t^2}{12m^2} \left( \frac{du_0}{dx} - \frac{du_n}{dx} \right) \\ & \quad - \frac{t-3mt^2+2m^2t^3}{12m^2} \left( \frac{d^2u_0}{dx^2} - \frac{d^2u_n}{dx^2} \right) \\ & \quad + \dots \end{aligned}$$

find the value of an apportionable annuity on  $(x)$ , the annuity being payable by  $m$ ly instalments, and  $\left(\frac{1}{m} - t\right)$  of a year having elapsed since the last instalment fell due.

#### PROCEEDINGS OF THE INSTITUTE.—SESSION 1899-1900.

##### *First Ordinary Meeting, 27 November 1899.*

The first ordinary meeting of the session 1899-1900 was held at the Hall of the Institute, on the 27th day of November 1899.

The President (Mr. H. W. MANLY) in the Chair.

The President delivered an inaugural address.

##### *Second Ordinary Meeting, 18 December 1899.*

The President (Mr. H. W. MANLY) in the Chair.

Mr. James Burnett Gibb, F.F.A., was duly elected an Associate.

A paper entitled "Some Notes on Makeham's Formula for the Force of Mortality", was read by the author, Mr. H. P. Calderon.

The following gentlemen took part in the discussion:—Messrs. G. F. Hardy, J. Burn, and the President.

##### *Third Ordinary Meeting, 29 January 1900.*

The President (Mr. H. W. MANLY) in the Chair.

A paper entitled "Increasing Reversionary Charges", was read by the author, Mr. W. B. Paterson.

The following gentlemen took part in the discussion:—Messrs. J. E. Faulks, R. R. Tilt, D. A. Bumsted, J. Chisholm, and the President.

##### *Fourth Ordinary Meeting, 26 February 1900.*

The President (Mr. H. W. MANLY) in the Chair.

A paper entitled "On Surrender-Values and the Principles which Underlie their Calculation", was read by the author, Mr. F. W. Fulford.

The following gentlemen took part in the discussion:—Messrs. G. S. Crisford, O. Kentish, A. D. Besant, J. Chatham, F. Bell, and the President.

*Fifth Ordinary Meeting, 26 March 1900.*

Mr. G. H. RYAN (Vice-President) in the Chair.

A paper entitled "The Methods of Analyzing and Presenting the Mortality, Sickness, and Secession Experience of Friendly Societies, with Examples drawn from the Experience of the Manchester Unity of Oddfellows", was read by the author, Mr. A. W. Watson.

The following gentlemen took part in the discussion:—Messrs. F. Schooling, C. H. E. Rea, R. P. Hardy, Reuben Watson, R. W. Moffrey (a Visitor), and the Chairman.

*Sixth Ordinary Meeting, 30 April 1900.*

The President (Mr. H. W. MANLY) in the Chair.

The President announced that three Essays on "The Rationale of Discounted Bonus Premiums" had been sent in to compete for the Prizes offered by Mr. James Chisholm, the competition being open to Members of the Institute who had qualified for the Fellowship since 1 January 1897; and that the Adjudicators had awarded the following Prizes, namely, First Prize of £15 to the Essay written by Mr. Henry Moir. The Essays written by Messrs. J. Mayhew Allen and H. E. W. Lutt respectively, were considered by the Adjudicators so nearly equal in merit that they had bracketed them for the Second Prize, awarding £5 to each.

A paper entitled "Census Taking", was read by the author, Dr. Reginald Dudfield, M.A., M.B., D.P.H.

The following gentlemen took part in the discussion:—Messrs. G. H. Ryan, R. Todhunter, M. N. Adler, Dr. Ginsburg (a Visitor), and the President.

*The Fifty-third Annual General Meeting, 7 June 1900.*

The President (Mr. H. W. MANLY) in the Chair.

The proceedings at the Annual General Meeting will be found on page 408.

## REPORT, 1899-1900.

The Council have pleasure to report to the members upon the progress of the Institute during the session of 1899-1900, the fifty-second year that it has been in existence.

There has been a *decrease* of 12 in the number of members, as compared with the previous year. Under the new rules for admission, 45 candidates have been admitted as Probationers, and 34 as Students, conditionally on their passing Part I of the Examination. A fair proportion of these gentlemen will, no doubt, have qualified themselves for members by passing the requisite Examination in April. At the end of the year in which the Institute was incorporated by the Royal Charter the number of members was 434, while five years later, at 31 March 1890, it was 601. Since that time it has grown as follows:

At 31 March	1891	to	620,
"	1892	"	645,
"	1893	"	674,
"	1894	"	734,
"	1895	"	775,
"	1896	"	788,
"	1897	"	826,
"	1898	"	860,
"	1899	"	834,
"	1900	"	822.

The following schedule shows the additions, changes, and losses in the membership, which have occurred during the year ending 31 March last.

*Schedule of Membership, 31 March 1900.*

	Honorary Members	Fellows	Associates	Students	Corres- ponding Members	Total
i. Number of Members in each class on 31 March 1899 .	1	195	248	373	17	834
ii. Withdrawals by						
(1) Death . . .	...	...	1	...	...	50
(2) Resignation . .	...	...	6	16	...	
(3) Default in pay- ment of Sub- scriptions . .	...	...	3	24	...	
iii. Additions to Membership	1	195	238	333	17	784
(1) By Election . .	...	...	2	...	...	38
(2) By Order of Council	...	...	...	36	...	
(3) By Re-instatement	...	...	...	...	...	
iv. Transfers	1	195	240	369	17	822
(1) By Examination:						
<i>from Associates</i>	...	...	8	...	...	...
<i>to Fellows</i> .	...	8	...	...	...	...
(2) By Examination:	1	203	232	369	17	822
<i>from Students</i>	...	...	...	3	...	...
<i>to Fellows</i> .	...	3	...	...	...	...
(3) By Examination:	1	206	232	366	17	822
<i>from Students</i>	...	...	...	27	...	...
<i>to Associates</i> .	...	...	27	...	...	...
v. Number of Members in each class on 31 March 1900 .	1	206	259	339	17	822

The Council have, with great regret, to report the loss by death of one Associate, namely, Mr. W. D. Whiting, M.D., LL.B.

The accounts for the year show that the total funds on 31 March last amounted to £7,424. 18s., being a decrease during the year of £187. 14s. 9d. In this connection, however, it will be seen that a considerable amount of special expenditure has been incurred, namely, £506. 14s. 7d., being the balance of the cost of printing the volume of

Transactions of the 1898 International Congress, and £304. 13s. 3d. for additions and improvements to bookcases.

It will be observed that the Library Fund has disappeared from the Accounts, the Council having decided that the expenditure connected with the Library should be defrayed therefrom until the Fund was exhausted, which has now occurred in consequence of the above expenditure.

The Council point with satisfaction to the new bookcases which have been erected under the supervision of the Library Committee. and which will form a much-needed protection to the books.

The Annual Subscriptions, together with admission and other fees, amounted to £1,732. 10s., showing a slight decrease as compared with those of the previous year. The total Income for the year was £2,229. 12s. 10d., and the total Expenditure £2,417. 7s. 7d. The Revenue Account and Balance Sheet are given herewith (p. 407).

The stock in hand of the Institute publications on 31 March was as follows:

No. of Copies	Description of Work
52 . . . . .	<i>Text-Book</i> , Part II.
756 . . . . .	Government Joint-Life Annuity Tables.
824 . . . . .	Select Life Tables.
746 . . . . .	A Short Collection of Actuarial Tables.
190 . . . . .	Logarithm Cards.
323 . . . . .	Messenger Prize Essay (Friendly Societies).
54 in cloth )	( Lectures on Finance and Law (Clare and
3,088 in paper )	
1,782 . . . . .	( Wood Hill).
	Lectures on the Companies Acts (A. C. Clauson).
920 . . . . .	Proceedings of the Second International Congress of Actuaries.
514 . . . . .	Index to 10 Vols.
13 . . . . .	„ to 20 „
1,019 . . . . .	„ to Vols. 21 to 30.
9,331 . . . . .	Parts of <i>Journal</i> .

The following papers were submitted at the sessional meetings of the Institute, namely:

- 27 *November* 1899.—An inaugural address by the President, Mr. H. W. Manly.
- 18 *December* 1899.—“Some Notes on Makeham’s Formula for the Force of Mortality”—Mr. H. P. Calderon.
- 29 *January* 1900.—“Increasing Reversionary Charges”—Mr. W. B. Paterson.
- 26 *February* 1900.—“On Surrender-Values and the Principles which Underlie their Calculation”—Mr. F. W. Fulford.
- 26 *March* 1900.—“The Methods of Analyzing and Presenting the Mortality, Sickness, and Secession Experience of Friendly Societies, with Examples drawn from the Experience of the Manchester Unity of Oddfellows”—Mr. A. W. Watson.
- 30 *April* 1900.—“Census Taking”—Dr. Reginald Dudfield, M.A., M.B., D.P.H.



For the Examinations held in the United Kingdom on 20, 21, 23, and 24 April last, 189 candidates presented themselves, namely:

67	for Part	I.
65	„ „	II.
33	„ „	III, Section A.
24	„ „	III, „ B.

Of these the following numbers were successful:

30	in Part	I.
22	„ „	II.
7	„ „	III, Section A.
7	„ „	III, „ B.

The following are the successful candidates, the names in each class being arranged alphabetically.

#### PART I.

*Examiner*—PROF. S. L. LONEY, M.A.

*Supervisors*—MESSRS. F. E. COLENZO, M.A., and J. E. FAULKS, B.A.

##### *Class I:*

Baxter, E. H.	Neill, S. B.
Bell, H. S.	Shovelton, S. T.
Milligan, C. L.	Worth, B. O.

##### *Class II:*

Davies, W. A.	Hughes, A. S.
Elderton, R. L.	Jarman, W. R.
Garner, J.	Thompson, F. R. T.
Grant, K. S.	Wares, H. W.

##### *Class III:*

Borrajo, E. J. W.	Hobbins, C. B.
Bennett, S.	Jenkyn, J.
Chambers, J. J.	Johnston, A. E.
Cooper, B. H.	Kennedy, E. R.
Doust, W. F.	May, W. T.
Goodman, G.	Searle, A. J.
Green, J. P.	Wandless, J. R.
Hammond, R.	Woodhouse, H. A.

#### PART II.

*Examiners*—MESSRS. W. O. NASH, B. A. BERRY, B.A.,  
A. D. BESANT, B.A., and A. E. MOLYNEUX.

##### *Class I:*

None.

##### *Class II:*

Bacon, J.	Hicks, A. J.
Brown, Hy.	Kelham, C. S.
Curtis, W. A.	Richmond, G. W.
Young, A. S.	

*Class III:*

Ball, S. R.	McArthur, H. de C.
Chandler, T. R.	Minns, E. E.
Diver, O. F.	Nash, A. C.
Harding, H. B.	Oakley, H. J. P.
Hines, W. R.	Peters, C. F.
Hurst, H. A.	Searls, E. R.
Maunder, G. H.	Sharpe, E. C. E.
	Wilson, G.

## PART III.

*Examiners*—MESSRS. GEOFFREY MARKS, T. G. ACKLAND, H. W. ANDRAS,  
H. E. NIGHTINGALE, G. J. LIDSTONE, and L. F. HOVIL.

## SECTION A.

*Class I:*

Moorhouse, A.

*Class II:*

Sharman, W. C.

*Class III:*

†Fraser, A.

†\*Gibson, P.

†Macnaghten, S. E.

†Morgan, B. C.

Searle, G. M.

## SECTION B.

*Class I:*

None.

*Class II:*

Buchanan, J.

Elderton, W. P.

†\*Gibson, P.

*Class III:*

Gibb, J. B.

Gordon-Smith, R.

†Marr, V.

Norton, W. E.

Those marked (†), have now completed the examination for the Class of Fellow.

(\*) Mr. Gibson passed in both sections.

In the Colonies the Examination entries numbered 59, as under:

For Part I, 29.

„ II, 24.

„ III, Section A, 2.

„ III, „ B, 4.

The results of the Colonial Examinations will be duly announced.\*

The Council warmly acknowledge the valuable services of the Honorary Examiners.

The Executive Committee of the International Congress of Actuaries, held in London in 1898, having completed their labours with the issue of the volume of Transactions, have rendered an account of the Receipts and Disbursements. The subscriptions from 396 members and subscribers amounted to £396. 10s., and the expenses of collection, postage, reporting proceedings, translations, and printing connected with the preliminary arrangements and meetings, amounted to £138. 2s. 5d. Printing 1,500 copies of the Proceedings, and binding 700 copies, cost £765. 2s. 2d., leaving a deficiency of £506. 14s. 7d., which sum has been provided out of the Funds of the Institute. Every member and subscriber has received a free copy of the Transactions, and the remaining copies have been handed over to the Institute, which will benefit by the proceeds of sales of this valuable and important work.

The Council are gratified to find that the actual cost to the Institute so closely approached the original estimate of £500; and they feel that the

\* The results are given on page 415.

thanks of the profession are due, and will be gratefully accorded, to the Executive Committee for their excellent arrangements and management of the Congress, and the successful preparation and completion of the volume of Transactions.

The Mortality Investigation, which is being conducted jointly by the Institute of Actuaries and the Faculty of Actuaries, has made material progress during the year, under the honorary supervision of Mr. T. G. Ackland. The volume containing the unadjusted data of the Annuity Experience has already been published. It has been decided to include in one volume the unadjusted data relating to Endowment Assurances and Minor Classes of Assurance, Male and Female; and the Council have the satisfaction to report that this volume, forming a second of the series, is now completed, and on the eve of publication. The extensive tables comprising the unadjusted data for Whole-Life Assurances, Male Lives, are in the printers' hands, and will, when ready, form a third volume of the series. These will be followed, so far as the unadjusted data are concerned, by a fourth and final volume, which will contain the experience of Whole-Life Assurances, Female Lives. The tables to be included in this final volume are finished, and are in course of being copied for the printer.

As soon as the necessary re-sortings have been made, the whole of the Assurance cards will be returned to the contributing offices.

The Annuity Tables have been graduated by Mr. G. F. Hardy; and the computation of the Monetary Tables, based upon the graduated Tables, has been placed by the Committee under the direction of Mr. Meikle, in Scotland. Mr. G. F. Hardy has also been invited to undertake the graduation of the Whole-Life and Endowment Assurance Tables, and has made considerable progress with the work.

A circular was issued in June last, announcing that Mr. James Chisholm had kindly left the balance (£25) of the Prizes offered by him in 1896, but not awarded by the Adjudicators, at the disposal of the Council, who had decided to offer two Prizes, of £15 and £10 respectively, for the best two Essays, to be written by Members of the Institute who had qualified for the Fellowship since 1 January 1897, on the following subject: "*The Rationale of Discounted Bonus Premiums.*" Three Essays were received, to which the Adjudicators awarded the following Prizes, namely, First Prize of £15 to the Essay bearing the motto "To win the Secret of a Weed's Plain Heart", written by Mr. Henry Moir. The Essays bearing the mottoes "Apparent rari nantes in gurgite vasto" and "Quod erat faciendum", written by Mr. J. Mayhew Allen and Mr. H. E. W. Lutt respectively, were considered by the Adjudicators so nearly equal in merit that they have bracketed them for the Second Prize, awarding £5 to each.

It has been decided to publish new editions of the *Text-Book*, Parts I and II respectively, but, with a view of meeting present requirements, a further 100 copies of the first edition of Part II have been printed.

The preparation of Part I has been entrusted to Mr. R. Todhunter, M.A., who has made considerable progress with the work. The first four chapters are already in type.

Mr. George King is preparing a new edition of Part II, which will no doubt be ready for publication before the next Annual Meeting.

A Card Index to the *Journal* is in preparation, for use in the Hall of the Institute. Satisfactory progress has been made with the work, which will necessarily occupy a considerable time.

The series of six lectures on "The Companies Acts", delivered last session by Mr. A. C. Clauson, Barrister-at-Law, in Staple Inn Hall, have been published during the year.

Amount of funds at the beginning of the year—		£	s.	d.
General Fund . . . . .	6,770	17	4	
Messenger Legacy Fund . . . . .	334	12	7	
Brown Prize Fund . . . . .	238	5	5	
Chisholm Prize Fund . . . . .	25	0	0	
Library Fund . . . . .	223	17	5	
				7,612 12 9
Subscriptions—				
Fellows . . . . .	551	5	0	
Associates . . . . .	473	11	0	
Students . . . . .	325	10	0	
Probationers . . . . .	35	3	6	
				1,385 9 6
Application Fees—				
Associates . . . . .	4	4	0	
Students . . . . .	49	17	6	
Probationers . . . . .	26	5	0	
				80 6 6
Examination Fees . . . . .				266 14 0
Sales of Publications—				
Journal . . . . .	150	9	9	
Text-Book, Part II . . . . .	71	12	9	
Institute Life Tables . . . . .	3	13	6	
Government Amnity Tables . . . . .	4	0	8	
Select Life Tables . . . . .	17	13	4	
Short Collection of Actuarial Tables . . . . .	4	5	3	
Hardy's Friendly Societies . . . . .	1	0	3	
Legal and Financial Lectures . . . . .	25	6	3	
Logarithm Cards . . . . .	3	14	2	
				281 15 11
Dividends and Interest (less tax) . . . . .	215	6	11	
				£9,842 5 7

*Balance Sheet, 31 March 1900.*

LIABILITIES.		£	s.	d.
General Fund . . . . .		6,792	2	9
Messenger Legacy Fund . . . . .		233	9	2
Accumulated Dividends . . . . .		108	6	0
				341 15 2
Brown Prize Fund . . . . .		200	0	0
Accumulated Dividends . . . . .		66	0	1
				266 0 1
Chisholm Prize Fund . . . . .		25	0	0
				£7,424 18 0
ASSETS.				
Natal 3 per-cent Inscribed Stock (£3,000), cost . . . . .		2,846	6	0
Metropolitan Railway 4 per-cent Debenture Stock (£1,050), cost . . . . .		1,185	11	3
Great Eastern Railway 4 per-cent Debenture Stock (£800), cost . . . . .		1,031	10	3
Great Northern Railway Preferred Ordinary Stock (£600), cost . . . . .		703	11	6
Great Western Railway 4 per-cent Debenture Stock (£600), cost . . . . .		972	19	9
Outstanding Subscriptions . . . . .		52	10	0
Cash on Deposit Account . . . . .		£250	0	0
Current Account . . . . .		382	9	3
				£7,424 18 0

[The Institute also possesses certain copyrights and stocks of publications (see p. 403).]

*Examined and found correct, 25 April 1900.*

C. H. P. REA,  
L. K. PAGDEN,  
A. MACKAY, } *Auditors.*

*Examined and found correct, 25 April 1900.*

C. H. P. REA,  
L. K. PAGDEN,  
A. MACKAY, } *Auditors.*

Amount of Funds at the end of the year, as per Balance Sheet . . . . .

£87 13 1  
7,424 18 0

Journal—		£	s.	d.
Printing of Nos. 193, 194, 195, and 196 . . . . .		347	6	6
Clerical assistance . . . . .		30	0	0
				377 6 6
Library—binding and purchases . . . . .				
Additions and improvements to bookcases . . . . .		33	1	9
				304 13 3
Republish of Text-Book, Part II . . . . .				
Publications Account—Binding and Registration of Copyrights . . . . .		337	15	0
Meetings . . . . .		40	14	3
Examination charges . . . . .		7	14	0
Congress—Balance of cost of printing Volume of Transactions . . . . .		54	16	11
Lecturers for classes in Parts I and II . . . . .		71	18	4
Lectures on Finance and Law . . . . .		506	14	7
Legal charges . . . . .		52	10	0
		107	1	11
				3 3 0
Office Expenditure—				
Rent . . . . .		275	0	0
Salaries . . . . .		323	8	0
House expenses . . . . .		53	2	10
Corporation Duty . . . . .		9	0	5
Fire Insurance . . . . .		13	8	0
Stationery and Printing . . . . .		111	13	3
Postage and Telegrams . . . . .		36	11	9
Furniture . . . . .		31	8	11
Stundres . . . . .		3	19	11
				857 13 1
Amount of Funds at the end of the year, as per Balance Sheet . . . . .				7,424 18 0

£9,842 5 7

£  
2,846 6 0  
1,185 11 3  
1,031 10 3  
703 11 6  
972 19 9  
52 10 0  
£250 0 0  
382 9 3  
£7,424 18 0

## PROCEEDINGS AT THE ANNUAL GENERAL MEETING.

The Report of the Council (given on p. 401) having been read,

The PRESIDENT—Gentlemen, the Report is so comprehensive and complete that there is little for me to enlarge upon. The rule that no one shall become a member until he has passed Part I of the examination, coupled with the establishment of a class of probationers, has been most effective, and has had an excellent result in many ways, not the least being that our junior clerks can obtain all the privileges of students for half fees. This accounts for a slight diminution in the income from subscriptions. The Library Fund, which was raised on the initiative of Mr. Newbatt, has disappeared from the accounts, the money having been expended on the bookcases which you see round the hall, and which will preserve the valuable collection of works which we have stored there. (Cheers.) The activity and vitality of the Institute are shown in the variety of subjects discussed at our sessional meetings, and the excellent attendance of the members at those meetings. The discussions were well sustained, and displayed the existence of a large amount of latent talent amongst the junior Fellows, which was brought to light by making them referees of the papers. I trust that the favourable impressions which they made on the occasion of their first descent into the arena of public discussion will encourage them to become frequent speakers at our meetings. I desire to congratulate those members who have succeeded in passing the examinations which they entered for, and particularly the five gentlemen who are now entitled to the full honours of fellowship. (Cheers.) I would, however, urge them not to rest satisfied with having passed their examinations, because that is not sufficient now-a-days to mark them out for promotion. They have shown what they know; they must now show what they can do. The Institute offers many facilities for the display of original thought and talent, and recently encouraged the younger fellows to come forward by limiting the competition for Mr. Chisholm's prizes to those who had passed their final examinations since the first of January 1897. Three essays were sent in on the occasion, and were all considered by the adjudicators to have been of a sufficiently high standard of merit to justify a prize being given to each. I very heartily congratulate Mr. Moir on being awarded the first prize for an essay of great power and original treatment, and I must also congratulate Mr. Mayhew Allen and Mr. Lutt upon their essays, which, although not displaying the same breadth of view and wide, practical grasp of the subject which distinguished Mr. Moir's, were exceedingly good and give great promise for the future. The success which these gentlemen have attained will be followed, I hope, by success in their professional careers. (Cheers.) There is one striking example I have to record of useful and successful work in the service of the Institute being followed by worthy promotion—I refer to Mr. Todhunter, who has recently been appointed actuary to the University Life Office. I am sure that we all offer him our sincere congratulations on this appointment, and we congratulate the University on securing a talented actuary and an earnest and skilful manager. It is a coincidence which I hope the members will note, that all



three editors of the Institute Text-books received chief appointments during the progress of their work. Mr. Todhunter, having been a successful tutor, was invited by the Council to prepare an entirely new edition of Part I, and has already made considerable progress with the work. Four chapters are already in print, and, I believe, the remainder of the work is far advanced. I hope his new duties will not greatly interfere with the completion of it by an early date. The executive committee of the Second International Congress, which was held in London, has dissolved itself, much, I may say, to the relief of the members of that committee. Having been one of the members, my modesty will not allow me to enlarge upon the anxieties, the troubles, and the labours connected with it, nor on its final success, but I will say this, that the hardest-worked member of the committee was Mr. King—(cheers)—who undertook the editing of the *Transactions*—a work involving enormous labour, patience, energy, and literary talent, and which he executed, as we all felt he would, with his usual skill and ability. Mr. King certainly deserves our heartiest thanks for this latest mark of his devotion to the service of the Institute. (Cheers.) The mortality investigation conducted jointly by the Institute and the Faculty is, I am happy to say, fast approaching completion so far as the tabulation of the unadjusted data is concerned. At the last annual meeting I had the pleasure to produce a bound copy of the annuity experience. It is my pleasure to-day to produce a bound copy of the second volume of this series—the Unadjusted Data relating to endowment insurance and the minor classes of insurance, which comprise whole-life assurances with limited payments, whole-life assurances with increasing premiums, joint-life assurances, contingent survivorship assurances, and temporary assurances. These data form a small portion of the whole, and as all the work was carried on concurrently, the smallness of the data accounts for the production of the volume before the whole life; but the data for the whole-life assurance for male lives are now in the printers' hands, and the whole-life assurances—female lives—are finished and being copied for the printers. The whole of these unadjusted data will be contained in four volumes, and will form a valuable basis for every possible kind of investigation. You may be interested in hearing the statistics of this experience. This is the experience of the assurance business:—1,105,630 cards were contributed by 60 companies. The number of cases included in the experience, after elimination of duplicates, was 1,037,233. The total years of risk in the select tables is 11,426,023, and in the aggregate tables, where a second elimination of duplicates took place, 10,004,013, and the total deaths 234,211. This will give some idea of the magnitude and the value of the work. The Joint Committee have not waited for the completion of all the unadjusted data before starting upon the next and most important process of graduation and construction of monetary values. The two members most eminent in our profession for their skill in graduation were invited to graduate the annuity experience—Dr. Sprague and Mr. George Hardy. I need hardly say that both graduations were perfect of their kind; but, after submitting the graduated tables to the severest tests, it was decided to adopt Mr. Hardy's, as giving on the whole better results, being less cumbersome, and, from being based on Makeham's formula, giving greater facilities for the

calculation of joint-life annuities and complex problems. It is a beautiful piece of work, and we are all intensely indebted to Mr. George Hardy for this new masterpiece of skill and ingenuity. (Cheers.) We shall not, I hope, lose the advantage of an extended graduation by the graphic method, as we trust that Dr. Sprague will be induced to complete the tables on his principle of graduation, and we shall then have, I hope, two of the most perfectly graduated tables that it is possible to have. When I say that our ever-youthful friend, Mr. Meikle, has undertaken the computation of the monetary tables for the annuity experience, I think you will agree it is a guarantee that they will not only be accurate and complete, but they will be produced in the least possible time. I have now to move, gentlemen, that the report and accounts be received and adopted. (Cheers.)

Mr. WILLIAM HUGHES, in seconding the motion, said there was one point in the report which might have attracted attention, namely, that the gross number of members had somewhat decreased during the last three years. That was partly accounted for, however, not by any want of popularity on the part of the Institute, but by certain re-adjustments and alterations in the rules. As for the popularity of the Institute, it was evidenced by the large number of students that continued to attend the classes and to present themselves for examination. He looked upon that as a matter for the greatest congratulation. He was aware that there were two views on that subject; but he thought the general view was that it was a matter for great congratulation that so large a number of young men in insurance companies thought it worth their while to face the very hard intellectual labour which was involved in getting up the subjects for examination and in presenting themselves so as to qualify for the post of actuary, should such good fortune ever happen to come in their way. The large number of students had severely taxed the resources of the Institute in the matter of room. The Hall, large as it was, was not large enough to contain the examinees. A large room had been obtained in the neighbourhood where some of the examinees were sent, but whether that room would remain available for any number of years to come was a question upon which he could not pronounce any opinion; but the Institute intended to make arrangements of its own. Plans had been prepared, and it was hoped that they would have got a good deal more forward towards the preparation of a large room on the adjacent vacant ground, but the lawyers, with that rapidity which characterized their race, hoped to be able to put the Institute in possession of the ground some time during the next twelve months. When that was done a room would very soon be provided which would be more worthy of the purposes for which the Hall was used. The miserable apartment which did so well as the kitchen for Staple Inn Hall when the ancients used to go there to dine, was not worthy of the dignity of the Institute as a class-room and examination room. He begged to second the motion for the adoption of the report.

The resolution was carried unanimously.

## ELECTION OF PRESIDENT, VICE-PRESIDENTS, COUNCIL AND OFFICERS.

Messrs. Calderon and Holliday were appointed Scrutineers of the ballot for the election.

The ballot then took place, and the President announced that the following list of Fellows, recommended by the Council for election, had been unanimously elected :

*President.*

CHARLES DANIEL HIGHAM.

*Vice-Presidents.*

GERALD HEMMINGTON RYAN.  
FRANK BERTRAND WYATT.

JAMES CHISHOLM.  
ARTHUR FRANCIS BURRIDGE.

*Council.*

\*HENRY WALSINGHAM ANDRAS.  
DAVID ALEXANDER BUMSTED.  
ARTHUR FRANCIS BURRIDGE.  
JAMES CHATHAM.  
JAMES CHISHOLM.  
FRANCIS ERNEST COLENSO, M.A.  
\*HENRY COCKBURN.  
ERNEST COLQUHOUN.  
STANLEY DAY.  
JOSEPH ERNEST FAULKS, B.A.  
ALEX. JOHN FINLAISON, C.B.  
GEORGE FRANCIS HARDY.  
RALPH PRICE HARDY.  
AUGUSTUS HENDRIKS.  
CHARLES DANIEL HIGHAM.

\*LOUIS FREDERICK HOVIL.  
GEORGE KING.  
\*GEORGE JAMES LIDSTONE.  
HENRY WILLIAM MANLY.  
WILLIE OSCAR NASH.  
PHILIP LEWIN NEWMAN.  
HARRY ETHELSTAN NIGHTINGALE.  
GERALD HEMMINGTON RYAN.  
\*FREDERICK SCHOOLING.  
JAMES SORLEY.  
THOS. BOND SPRAGUE, M.A., LL.D.  
GEORGE TODD, M.A.  
ERNEST WOODS.  
FRANK BERTRAND WYATT.  
THOMAS EMLEY YOUNG, B.A.

\* Not Members of the last Council.

*Treasurer.*

HENRY COCKBURN.

*Honorary Secretaries.*

ERNEST WOODS.

| FREDERICK SCHOOLING.

Mr. C. D. HIGHAM, who was received with cheers, said—Gentlemen, if there is one time above all others when the golden eloquence of silence is better than silvery speech, it is when you have just elected one of your number to the highest office within your gift; and while I thank you warmly and sincerely for your generous appreciation, yet I crave your indulgence if my words appear cold, and I seem lacking in the enthusiasm with which so noble a heritage should be taken up. For I am appalled when I think of the demands made on the abilities of your President, and how admirably those demands have been fulfilled in the past; and I know

how great my own shortcomings must be as I endeavour to follow in those steps. But I remember that your President has never failed to have the support and encouragement, not only of his colleagues, but of every member of the Institute; and so I take up the burden with a good courage, and I promise that so far as any poor powers of mine extend, no effort of skill or of will shall be wanting to maintain the fair fame of the Institute as it now exists; and when the time comes for you to relieve me of the trust, I shall be satisfied if you will grant me this meed of approbation, that I did my best. (Cheers.) So much for myself. And forgive me for speaking of myself first. But I am to return thanks also for the election of the Vice-Presidents, the Council, the Treasurer, and the Secretaries, who all have their own vocations, and vocations implying an amount of work which is great, and which is increasing to an extent hardly, I think, realized except by those who have experienced it, and perhaps especially that is the case with the Secretaries. (Hear, hear.) But whatever the work may be, we shall not be afraid of it. I thank you on their behalf and again on my own, and we shall endeavour to show by deeds rather than by words that we are not unmindful of the confidence reposed in us to-day. (Cheers.)

On the motion of Mr. LEVINE, seconded by Mr. HUTTON, Messrs. Pagden and Mackay were re-elected and Mr. T. J. Dell elected Auditors for the ensuing year.

Mr. EMORY MCCLINTOCK, in proposing a vote of thanks to the President, Vice-Presidents, Council, Officers, and Examiners for their services during the past year, said he had the more pleasure in making the proposition, because he had so seldom an opportunity of meeting the members of the Institute, of which he had been a Fellow for so many years. It was a necessary result of living at a great distance, and he felt it to be a serious hardship; but living at a distance, and being an American and a member of other actuarial societies, he thought he might all the more properly express the gratitude which the American Society and other societies did and ought to feel for the work done by the President, Council, and Officers of the Institute of Actuaries. (Hear, hear.) The work they did was a constant example for the emulation of the officers of every other society. The work done by the President was perhaps more prominent than that done by the others. It certainly was more responsible. When he said the President's work was more prominent, he meant it was more visible than the work of the Secretaries and the Examiners. He thought the Institute had been particularly fortunate in its President, Mr. Manly. He was glad to welcome Mr. Manly two years ago when he was first elected, and he was sorry to see him leave the chair. He felt sure that was the feeling of everyone present. (Hear, hear.) The representative of the old Equitable, which was the very fountain and origin of the science which they all professed, must always hold an exceedingly high place in the profession of actuaries, whether in this country or any other. (Hear, hear.) They had heard about the work of the Secretaries, and he could well imagine that it was getting more and more laborious, as the profession was constantly growing. The correspondence with the growing bodies outside, and especially in relation to International Congress matters, must have added greatly to their labours during the past year. He supposed the



hardest work was done by the Examiners. He noticed from the Report that 189 gentlemen presented themselves for examination in the United Kingdom alone, to say nothing of those elsewhere. He did not know whether the Editor of the *Journal* was an officer strictly speaking or not, but he hoped he was included in the minds of the members in discussing the question of thanks for the past year, because though his name did not appear, his work did, and it was most effective. One thing had struck him in the list of Officers and Council to be elected, namely, the names of various ex-Presidents. In the Actuarial Society of America there was a different custom. There the Presidents when they ceased from office became members for life of the Council, and did not require to be constantly elected, as he believed was the very proper custom in the English Society. He was not venturing to propose a change in the laws of that venerable body, but it did seem to him that at any rate it might be worth thinking about during the next few years; and when the bye-laws were altered—if they ever were altered—something might be done in the direction of reserving an honourable and appropriate place for the past Presidents of the Institute. He had a certain authority in speaking on the subject, because it had worked so well in the American Society. Every year certain members of the Council had to be elected, and if past Presidents were to come up for re-election, it would be only a matter of common courtesy to re-elect them regularly, but by having them out of the way it gave free scope for continual change and progress in the body of the Council. Thus, the former Presidents, who were active and interested in the affairs of the Council, continued, and were as active as any others—from their experience they must be—and if there were any others who from inability or distance were unable to attend, they did not take the place of those who could attend and might be elected. The suggestions he had made had occurred to him as he was looking over the list of Officers. He wished to repeat the pleasure it gave him in being selected to propose the vote of thanks to the President and the Officers. (Cheers.)

MR. A. H. BAILEY said he had great pleasure in seconding the motion. He most emphatically concurred with the suggestion that a vote of thanks should be extended to the Examiners. Some years ago he performed the duty of Examiner. He found out that it occupied a good deal of time, although then there were probably only about one-tenth of the number of candidates there were at the present time. With regard to Mr. McClintock's remarks, he thought it was very desirable indeed that those who had retired from the profession should not be members of the Council. A great deal was heard at present about too many old men being on the Council of the Incorporated Law Society. He wished to call the attention of the Council to the time at which the sessional meetings were held, which, to his mind, was most inconvenient. He had attended the meetings very regularly, and he had noticed when the paper had been read how steadily the room began to empty. Five o'clock would be much better than half-past five. He threw that suggestion out for the consideration of the Council.

The motion was carried with acclamation.

The PRESIDENT, on behalf of the Officers and himself, cordially thanked the members for the vote. The present was the last occasion on which he



would have the honour of addressing the Institute from the Chair. He wished to express the pride he had felt in occupying that position. That feeling had been enhanced by the manner in which Mr. McClintock had proposed and Mr. Bailey seconded and the members had expressed their regard in carrying the motion. With regard to the Officers, their duties were extremely onerous. As Mr. McClintock had said, their duties were growing greater and greater every year, and a very heavy task was put upon them, but the work was done cheerfully and willingly by them as members of the Institute in their desire to forward the interests of a Society from which they had themselves received so much benefit. He had been extremely fortunate in having two such able, worthy, and industrious secretaries as Mr. Burridge and Mr. Woods. (Cheers.) He also wished to express his thanks for the benefit and assistance he had received during his term of office from his friend Mr. Higham, to whom he wished every possible success in the occupation of the seat which he now vacated. (Cheers.) The Examiners were indeed worthy of the vote, for theirs was a very heavy task. It was no light matter to set the questions and mark examination papers now-a-days, and although it took a very large amount of time and thought, it was most cheerfully done for the service of the Institute. Personally, he thanked the members for the very great kindness and courtesy which had been extended to him during his term of office.

On the motion of Mr. BARTON, seconded by Mr. TAYLOR, a vote of thanks was passed to the auditors, Messrs. Rea, Pagden, and Mackay, for their services during the past year.

Mr. C. H. E. REA, in thanking the members for the very kind manner in which the resolution had been carried, said that the duty of auditing the accounts of the Institute was more a matter of pleasure than anything else. The books were kept in such excellent order by Mr. Wiggins that the auditors had no difficulty whatever in finding out everything they wanted to know; and during the slight indisposition of Mr. Wiggins recently, his assistant certainly showed that he was well up in the work, and readily gave all the information required. He felt very sorry to be relieved of the work of auditing the Institute's accounts—if it could be called work—because it was really a very great pleasure to make the audit. Moreover, attached to the duties, it might not be generally known that there was a cold luncheon—free. (Laughter.) On behalf of his colleagues and himself, he thanked the members for the vote.

The meeting then adjourned to Monday, 26 November.

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#### MR. CHISHOLM'S PRIZES.

At the monthly meeting of the Institute of Actuaries, held on 30 April, the President made the following announcement in reference to this matter:

“It will be remembered that, in June last, the Council announced that they had decided to utilize the balance of the prize-money offered by Mr. Chisholm in 1896, when only one award was made—that is to say, a

sum of £25—by offering two prizes of £15 and £10 for the best two essays on ‘The Rationale of the Discounted Bonus Premium’, to be written by members of the Institute who had qualified for the Fellowship since the 1st January 1897. It was with very much pleasure that the Council received three essays, all of very considerable merit. The adjudicators have carefully studied the papers, and have awarded the first prize to Mr. Henry Moir. The author has somewhat unnecessarily limited the scope of the paper, but he has shown that he possesses a very firm grasp of the subject, and has made a very full and exhaustive examination of the problem within the restricted limits. The other two essays are, as I have said, of considerable merit, and the authors have followed very similar lines of argument. The essays are, in fact, so similar in every respect that the adjudicators have decided to divide the second prize between the two competitors, namely, Mr. Harold E. W. Lutt and Mr. J. Mayhew Allen. I should like to congratulate these gentlemen on their success, and to go somewhat further and say that they have exhibited so much independent thought, and displayed so much ability in their treatment of the subject, that I would prophecy that they will obtain early promotion in their profession and earn higher distinction in their future careers. The present is the first time that the Council have placed a limitation upon the qualifications of the competitors, and the experiment has certainly proved a very great success. It is possible that the younger members have hitherto feared to put themselves into competition with their seniors for the larger subjects for which prizes have been offered, but this experiment shows that they need not have any fear whatever, for the authors have displayed a power and grip such as have been seldom seen, even among older competitors.”

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## COLONIAL EXAMINATIONS.

Examinations were held on 20, 21, 23, and 24 April, at Sydney, Melbourne, Adelaide, Wellington, Montreal, and Toronto, with the following results:

### PART I.

Twenty-nine Candidates sent in their names, of whom twenty-six presented themselves, and fourteen passed as follows:

#### *Class I:*

Hall, J. B. (Toronto).		Wilkinson, W. M. (Sydney).
Wood, W. A. P. (Toronto).		

#### *Class II:*

Kilgour, D. E. (Toronto).

*Class III:*

Bingeman, M. H. (Toronto).	Norsworthy, S. C. (Toronto).
Gillespie, J. H. R. (Toronto).	Paton, A. G. (Sydney).
Kirkham, A. (Melbourne).	Somerville, W. H. (Toronto).
Moore, G. E. (Melbourne).	Watt, A. W. (Montreal).
Norsworthy, E. C. (Toronto).	Woolston, P. L. (Montreal).

## PART II.

Twenty-four Candidates sent in their names, of whom eighteen presented themselves, and five passed as follows:

*Class II:*

Corbett, E. S. (Melbourne).	Wilson, J. S. (Melbourne).
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*Class III:*

Adams, C. F. (Wellington).	Burnley, Isaac (Wellington).
Earle, A. P. (Toronto).	

## PART III (SECTION A).

Two Candidates sent in their names, both of whom presented themselves, and one passed as follows:

*Class III:*

Sutherland, J. (Melbourne).

## PART III (SECTION B).

Four Candidates sent in their names, of whom three presented themselves, and one passed, namely:

*Class II:*

Sutherland, J. (Melbourne).

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*Additions to the Library.*

The following works have been added to the Library since the publication of the *Journal* for October 1899:

	<i>By whom presented (when not purchased).</i>
Actuarial Society of America. Proceedings of the	<i>The Society.</i>
Actuarial Society of Edinburgh. Proceedings of the	<i>The Society.</i>
American Mathematical Society. Transactions of the	<i>The Society.</i>
American Statistical Association. Proceedings of the	<i>The Association.</i>
Asō (G.). Advice to the Assured.	<i>The Author.</i>
Australian Mutual Provident Society. Fifty-first Annual Report, 1900.	<i>The A.M.P. Society.</i>
Austria. Bericht der Arbeiter-Unfall-Versicherungs-Anstalt für das Königreich Böhmen in Prag. 1898.	<i>Anonymous.</i>
Mittheilungen des Verbandes der österr. und ungar. Versicherungs-Techniker. Heft II.	<i>Anonymous.</i>
Mein Leidensweg als Staatsbeamter und Schriftsteller unter Inama Sternegg. Franz Carl Lukas.	<i>The Author.</i>
Belgium. Bulletin de l'Association des Actuaire Belges.	<i>L' Association.</i>
Comité Permanent des Congrès internationaux d'Actuaire. Bulletin No. 4.	<i>Le Comité Permanent.</i>
Commission des Pensions Ouvrières. Rapport sur les travaux de la Commission.	<i>Mons. Adan.</i>
Bentley (Joseph). Sixth Report to the Board of Trade, containing the Accounts of 301 Banks and Life Offices.	<i>Bequeathed by the late H. W. Porter.</i>
Birmingham, Insurance Institute of. Transactions for the Sessions 1893-4, 1894-5, 1895-6, and 1896-7.	<i>Purchased. The Insurance Institute.</i>
For the Session 1898-9.	<i>The Editor.</i>
Bourne's Handy Assurance Guide, 1900.	<i>The Editor.</i>
Bourne's Handy Assurance Manual.	
Bowack (W. M.). Method in Moral Science.	<i>The Author.</i>
Chartered Accountants of Scotland. Official Directory, 1899.	<i>The Publishers.</i>
Chrystal (G.), M.A., LL.D. Text-Book of Algebra. 2 vols.	<i>Purchased.</i>
Coglan (T. A.). Statistics of the seven Colonies of Australasia, 1861-98. Wealth and Progress of New South Wales, 1898-99.	<i>The Compiler.</i>

*By whom presented  
(when not purchased).*

**Dawson (Miles M.).**

Various Derived Tables. American Experience. One  
Life.

*The Author.*

**Faculty of Actuaries in Scotland.**

Library Catalogue, 1899.

*The Faculty.*

**Fairman (William).**

An Account of the several Public Funds. 6th Edition, } *Bequeathed by the*  
1816. } *late H. W. Porter.*

**Federation of Insurance Institutes of Great Britain and  
Ireland.**

Journal of the, Vols. I and II.

*The Secretary.*

**France.**

Bulletin de l'Institut des Actnaires Français.

*L'Institut.*

**Fuller (John E.).**

Computing Telegraph.

{ *Bequeathed by the*  
} *late H. W. Porter.*

**Gardner (John), M.D.**

Longevity: The Means of prolonging Life after Middle } *Bequeathed by the*  
Age. 1875. } *late H. W. Porter.*

**Germany.**

Assecuranz-Almanach, 1900. Dr. A. F. Elsner.

*The Editor.*

Zeitschrift des Königlich Preussischen Statistischen }  
Bureaus. 1900. }

*The German  
Government.*

Zustand und Fortschritte der deutschen Lebensver-  
sicherungs-Anstalten. 1899.

*The Publisher.*

**Giffen (Sir Robert), K.C.B.**

The Case against Bimetallism. 1898.

*Purchased.*

**Gold Standard.**

A Selection from the Papers issued by the Gold Standard  
Defence Association in 1895-1898.

*Purchased.*

**Gompertz (Benjamin).**

The Principles and Application of Imaginary Quantities; } *Bequeathed by the*  
to which are added some Observations on Porisms. } *late H. W. Porter.*  
1817.

**Holland.**

Archief voor de Verzekerings-Wetenschap.

*The Society.*

Jaarboekje van de Vereeniging voor Levensverzekering, }  
1900. }

*The Algemeene  
Maatschappij.*

Mededeelingen der Vereeniging voor Levensverzekering.  
Bundel 3.

*The Society.*

**Hutton (Charles).**

Mathematical Tables; containing the Common, Hyper- } *Bequeathed by the*  
bolic, and Logistic Logarithms. Sixth Edition. } *late H. W. Porter.*  
1822.

**Institute of Actuaries.**

Examination Papers:

Part I, 1873.

„ II, 1866, 1870, and 1874.

„ III, 1859, 1860, 1866, and 1868.

} *H. W. Manly.*



*By whom presented  
(when not purchased).*

- Institute of Bankers.**  
List of Members, 1899. *The Institute.*
- Institute of Chartered Accountants.**  
List of Members, 1900. *The Institute.*
- Institution of Civil Engineers.**  
List of Members, 1900. *The Institution.*
- Insurance Library Association of Boston.**  
Catalogue of the *Henry E. Hess.*
- Italy.**  
Bolletino della Associazione Italiana per l'incremento  
della scienza Degli Attuari. *The Association.*
- Joint Mortality Investigation.**  
Combined Experience of Life Annuitants, 1863-1893.  
Unadjusted Data. 2 copies. } *Joint Committee*  
Combined Experience of Assured Lives (1863-1893). } *on Mortality*  
Endowment Assurances and Minor Classes of } *Experience.*  
Assurance. Unadjusted Data. 2 copies. }
- Life Assurance Companies.**  
Returns, 1899. ) *The Board of*  
 ) *Trade.*
- Life Assurance Medical Officers' Association.**  
Transactions of the, for 1898 and 1899, and Part I,  
1900-1. *The Association.*
- Lisle (G.), C.A., F.F.A.**  
Accounting in Theory and Practice. *The Author.*
- Manchester, Insurance Institute of.**  
Reports, 1895-6, 1896-7, 1897-8, 1898-9. *The Insurance Inst.*
- McCall (John A.).**  
A Review of Life Insurance from the Date of the  
First National Convention of Insurance Officials, } *Bequeathed by the*  
1871-1897. } *late H. W. Porter.*
- Morrell (Charles Francis).**  
Bankruptcy. A Manual of Practical Law. 1891. *Purchased.*
- New South Wales, Insurance Institute of.**  
Proceedings of the. 1899. *The Insurance Inst.*
- Nottingham, Insurance Institute of.**  
Report, 1899-1900. *The Insurance Inst.*
- Parliamentary Papers.**  
Bills.  
Old Age Pensions. (Sundry.) }  
Truck Acts Amendment. } *Purchased.*  
Workmen's Compensation Act, 1897. (Amend-  
ment.) }  
Colonies.  
New South Wales.  
Statistical Register, 1898. } *The Government*  
Vital Statistics for 1898 and previous years. } *of N.S.W.*

*By whom presented  
(when not purchased).*

**Parliamentary Papers—(continued).**

- New Zealand.  
 Official Year Book, 1899.  
 Annual Report of the Government Insurance Commissioner, 1899.  
 Statistics of the Colony for 1898. } *The Government of New Zealand.*
- Victoria.  
 Friendly Societies — Twenty-first Annual Report by the Actuary for, for 1898. } *The Government of Victoria.*
- Education.  
 Elementary School Teachers' Superannuation Rules, 1899.  
 School Teachers' Superannuation Rules (Scotland), 1899.
- Emigration and Immigration.  
 Statistics for 1898.
- Friendly Societies.  
 Report of the Chief Registrar for, 1897. (Part C.)  
 " " " " 1898. (Parts A and B.)
- India (East).  
 Financial Statement for 1899–1900.  
 Indian Currency Committee, 1898.  
 Copy of Despatch of the Secretary of State to the Governor-General, respecting the Report of the Committee,  
 Report of the Committee, 1899.  
 Minutes of Evidence (Part II), 1899.  
 Index and Appendices to the Evidence.
- Local Taxation.  
 Memoranda chiefly relating to the Classification and Incidence of Imperial and Local Taxes.
- National Debt.  
 Return showing Liabilities and Assets at the close of each Financial Year, from 1835–36 to 1898–99 both inclusive.
- Old Age Pensions.  
 Index and Digest of Evidence to the Report on.  
 Registrar-General's Reports on Births, Deaths, and Marriages in England.  
 Sixtieth, and Supplement (Part II) to the Fifty-fifth Annual Report.  
 General Abstract. 1898.  
 Forty-third (detailed) and Forty-fourth (including Thirty-fourth Annual Report on Vaccination) Annual Reports (Scotland).  
 Thirty-fifth Annual Report (Ireland).
- Savings Banks.  
 Sundry Accounts of the
- Shop Clubs.  
 Report on
- Statutory Rules and Orders, 1899.
- Tuberculosis (International Congress).  
 Copy of Report of Rt. Hon. Sir Herbert Maxwell, Bart., M.P., F.R.S., and P. H. Pye-Smith, Esq., M.D., F.R.S., Government Delegates.
- Workmen's Compensation.  
 Statistics of the Proceedings in County Courts in England and Wales under the Act of 1897, and the Employers' Liability Act of 1880, during the year 1898.

*Purchased.*

*By whom presented  
(when not purchased).*

## Periodicals.

Accountants' Magazine.	<i>Purchased.</i>
Institute of Bankers' Journal.	<i>The Institute.</i>
Insurance Record, 1899.	<i>The Editor.</i>
Insurance Register, 1900.	<i>C. &amp; E. Layton.</i>
Insurance Spectator of London, 1899.	<i>The Editor.</i>
London Mathematical Society's Journal.	<i>The Society.</i>
Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland.	<i>Purchased.</i>
Post Magazine.	<i>The Editor.</i>
Post Magazine Almanac.	<i>The Editor.</i>
Royal Statistical Society's Journal.	<i>The Society.</i>
Zeitschrift für Versicherungs-Recht Wissenschaft.	<i>The Editor.</i>

## Richardson (J. H.).

State Life Insurance in New Zealand.	} <i>The Author.</i>
The Assessment of Life Risks where there is a pre- disposition to Phthisis or Cancer.	

## Rogers (J. E. Thorold).

The Economic Interpretation of History. 2 vols.	} <i>Purchased.</i>
4th Edition.	
Six Centuries of Work and Wages. 1894.	

## Rouse (William).

The Doctrine of Chances.	} <i>Bequeathed by the late H. W. Porter.</i>
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## Russia.

Tableau des Opérations des Sociétés d'Assurance Mutuelle contre l'Incendie, 1896.	} <i>The Russian Government.</i>
Tableau des Opérations des Compagnies d'Assurance, 1895, 1896.	

## Sheppard (W. F.), M.A., LL.M.

Central-Difference Formulæ.	} <i>The Author.</i>
A Method for extending the Accuracy of certain Mathematical Tables.	

## Society of Accountants and Auditors.

List of Members, 1900.	<i>The Society.</i>
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## Statistical Society of London.

History of the	<i>Purchased.</i>
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South Australian School of Mines and Industries, and  
Technological Museum.

Annual Reports, 1898, 1899.	<i>The Secretary.</i>
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## Switzerland.

Rapport du Bureau Fédéral des Assurances sur les Enterprises Privées en Matière d'Assurances en Suisse. 1898.	} <i>The Swiss Government.</i>
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## Thornton (Thomas).

The East Indian Calculator; or, Tables for assisting Computation of Batta, Interest, Commission, &c., in Indian Money.	} <i>Bequeathed by the late H. W. Porter.</i>
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## Toynbee (Arnold).

Lectures on the Industrial Revolution of the 18th Century in England. 1896.	<i>Purchased.</i>
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		<i>By whom presented (when not purchased).</i>
Victoria, Insurance Institute of.		
Report, 1899.	}	<i>The Insurance Institute.</i>
Walker (Francis A.), Ph.D., LL.D.		
International Bimetallism. 1896.		<i>Purchased.</i>
Williamson (Benjamin), D.Sc.		
An Elementary Treatise on the Integral Calculus.	}	<i>Purchased.</i>
An Elementary Treatise on the Differential Calculus.		
Yorkshire, Insurance Institute of.		
Report, 1898-99.	}	<i>The Insurance Institute.</i>

The following additional copies of works already in the Library have also been added.

		<i>By whom presented (when not purchased).</i>
Belgium.		
Premier Congr�s International d'Actuaires, Brussels,	}	<i>The Permanent Committee of Actuarial Congresses.</i>
1895. Documents. 2nd Edition.		
Bunyon (Charles John), M.A.		
The Law of Life Assurance. 3rd Edition, 1891.		<i>Purchased. J. E. Streeter.</i>
3 copies.		
The Law of Life Assurance. 1891.		
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The Law relating to Friendly Societies. Second Edition.		<i>Purchased.</i>
Indermaur (John), and Thwaites (Charles).		
The Student's Guide to the Law of Real and Personal Property and Conveyancing. Fourth Edition.		<i>Purchased.</i>
Jevons (W. Stanley), M.A., F.R.S.		
Money and the Mechanism of Exchange. 12th Edition, 1899.		<i>Purchased.</i>
Journal of the Institute of Actuaries.		
Nos. 67, 69, 70, 76, 80, 145, and 148.		<i>Dr. Sprague.</i>
Nicholson (J. Shield), M.A., D.Sc.		
A Treatise on Money, and Essays on Monetary Problems. 4th Edition. 1897.		<i>Purchased.</i>
Strahan (J. Andrew), M.A., LL.B.		
A General View of the Law of Property. 2nd Edition, 1897. 2 copies.		<i>Purchased.</i>
Sunderland (A. W.), M.A.		
Notes on Finite Differences. 3 copies.		<i>Purchased.</i>
Tillyard (Frank), B.A.		
Banking and Negotiable Instruments. 2 copies.		<i>Purchased.</i>

*By whom presented  
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**Williams (Joshua).**

- Principles of the Law of Personal Property. 14th }  
Edition, 1894. }  
Principles of the Law of Real Property. 18th }  
Edition, 1896. 3 copies. }

*Purchased.*

**Ansell (Charles).**

- Statistics of Families in the Upper and Professional  
Classes.

**Babbage (Charles).**

- A Comparative View of the various Institutions for  
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- Mathematical Tables. 1814.

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- Perpetual and Determinable Annuities reduced to a  
Level. 1792.

**Dodson (James).**

- The Mathematical Repository. 3 vols.

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- A Treatise on Life Assurance. 1823.

**Finlaison (A. G.).**

- Report and Observations on the Mortality of Govern-  
ment Life Annuitants. 1860.

**Gompertz (Benjamin).**

- On One Uniform Law of Mortality from Birth to  
Extreme Old Age, and on the Law of Sickness.  
A Sketch of an Analysis and Notation applicable to  
the estimation of the Value of Life Contingencies.  
1820.  
On the Nature of the Function expressive of the Law  
of Human Mortality; and on a New Mode of  
determining the Value of Life Contingencies.  
1825.  
Hints on Porisms. 1850.

*Bequeathed by  
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**Gray (Peter), H. A. Smith, and William Orchard.**

- Assurance and Annuity Tables. 1851.

**Hannington (Major-Gen. J. C.).**

- Table of Logarithms (Four Figures), 1 to 10,000.

**Hayes (Richard).**

- An Estimate of Places for Life: showing how many  
Years' Purchase a Life is worth. 1728.

**Highland Society of Scotland.**

- Report on Friendly or Benefit Societies. 1824.

**Insurance Blue Book and Guide for 1893-4.**

**Jones (David).**

- On the Value of Annuities and Reversionary Payments,  
with Numerous Tables. 2 vols. 1843.



*By whom presented  
(when not purchased).*

**Journal of the Institute of Actuaries.**

Vols. 1-34 inclusive.

**McClintock (Emory).**

On the Effects of Selection.

**Milne (Joshua).**

A Treatise on the Valuation of Annuities and Assurances  
on Lives and Survivorships. 2 vols. 1815.

**Morgan (William).**

On the Principles and Doctrine of Assurances,  
Annuities on Lives, and Contingent Reversions,  
stated and explained. 1821.

**Price (Richard).**

Observations on Reversionary Payments, &c., &c.  
2 vols. 1812.

**Scratchley (Arthur), M.A.**

Industrial Investments and Emigration; being a  
Treatise on Benefit Building Societies. 1851.

**Simon (L. M.).**

Report on the Mortality Experience of the Metropolitan  
Life Assurance Society from 1835-1890.

**Sprague (Thomas B.), M.A., LL.D.**

On Annuities. 1875.

**Teece (Richard).**

Report on the Mortality Experience of the Australian  
Mutual Provident Society, 1849-1888.

**Walford (Cornelius).**

The Insurance Guide and Handbook. 1867.

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1892	Adlard, Alfred Barton, Law Life Assur. Soc., 187 Fleet- street, E.C.	1850***	Bailey, Arthur Hutcheson, F.S.S. (PAST PRESIDENT, 1878-82), 26 Mount Ephraim-rd, Streatham, S.W.
1864***	Adler, Marcus Nathan, M.A., Alliance Assur. Co., Bartholo- mew-lane, E.C.	1896***	Baker, Henry James, Metropolitan Life Assur. Soc., 13 Moorgate-street, E.C.
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1897***	Allen, John Mayhew, Alliance Assur. Co., Bartholo- mew-lane, E.C.	1890***	Bearman, Harry, Gresham Life Assur. Soc., St. Mildred's-house, Poultry, E.C.
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1889***	Anderson, John, Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.	1867***	Berridge, George William, Dunton-lgy., The Knoll, Beeken- ham, Kent.
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*Clerical, Medical & General Life  
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square, s.w.*
- 1879 Besso, Marco, F.S.S.,  
*Superior Trade Council, Rome.*
- 1894\*\*\* Blackadar, Alfred Kimball, M.A.,  
*Mem. Act. Soc. Amer.,  
Government Insur. Department,  
Ottawa, Canada.*
- 1883\*\*\* Blakey, James,  
*National Debt Office, 19 Old  
Jewry, E.C.*
- 1897\*\*\* Bradshaw, Thomas, Mem. Act. Soc.  
Amer.,  
*The Imperial Life Assurance Co.  
of Canada, Toronto, Canada.*
- 1899\*\*\* Brown, Edward Harold,  
*Prudential Assurance Company,  
Holborn-bars, E.C.*
- 1875 Browne, Thomas G. C.,  
*Guardian Assurance Company,  
11 Lombard-street, E.C.*
- 1887 Browne, Willis,  
*India Office, s.w.*
- 1899\*\*\* Bull, Ernest James,  
*Atlas Assur. Co., 92 Cheapside,  
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- 1866\*\*\* Bumsted, David Alexander,  
*General Reversionary and In-  
vestment Co., Ltd., 26 Pall-mall,  
s.w.*
- 1894\*\*\* Burn, Joseph,  
*Prudential Assurance Company,  
Holborn-bars, E.C.*
- 1881\*\*\* Burridge, Arthur Francis, Mem.  
Act. Soc. Amer. (VICE-PRES.),  
*Equity and Law Life Ass. Soc.,  
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- 1887\*\*\* Byers, Frederick Timothy Mason,  
*Clergy Mutual Assurance Soc.,  
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minster, s.w.*
- 1888\*\*\* Calderon, Henry Philip,  
*30 Parkhurst-road, Bowes Park,  
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*Australian Mutual Provident  
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*Scottish Life Assurance Co.,  
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- 1875 Cherriman, J. B., Prof., M.A.,  
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Abchurch-lane, E.C.*
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Soc. Amer. (VICE-PRESIDENT),  
*Imperial Life Insurance Co.,  
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*Clerical, Medical and General  
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- 1863 Clirehugh, William Palin, F.S.S.,  
*London and Lancashire Life  
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Cornhill, E.C.*
- 1879 Cockburn, Henry, F.F.A., Mem.  
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*Scottish Provident Institution,  
6 St. Andrew-sq., Edinburgh.*
- 1898\*\*\* Cockman, Arthur Charles Road-  
night,  
*Liverpool and London and Globe  
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- 1884\*\*\* Colenso, Francis Ernest, M.A.,  
*Eagle Insurance Company, 79  
Pall-mall, s.w.*
- 1864\*\*\* Coles, John, F.S.S.,  
*39 Throgmorton-street, E.C.*
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*Legal and General Life Assur.  
Society, 10 Fleet-street, E.C.*
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- 1889\*\*\* Cooper, Walter George,  
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1869	Deuchar, David, F.F.A., F.R.S.E., Mem. Act. Soc. Amer., Caledonian Insurance Company, 19 George-street, Edinburgh.	1884	Frankland, Frederick William, F.S.S., Mem. Act. Soc. Amer., New York Life Insurance Co., 346 & 348 Broadway, New York.
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1886***	Dickinson, Arthur Lowes, M.A., F.C.A., 19 Coleman-street, E.C.	1895***	Fulford, Frederick Wesley, Prudential Assurance Company, Holborn-bars, E.C.
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1887	Douglas, Gordon, F.F.A., Life Association of Scotland, 82 Princes-street, Edinburgh.	1878	Gordon, Charles, F.F.A., South African Mutual Life Assurance Society, Cape Town.
1875***	Duncan, James Heron, Royal Exchange Assurance Corp., Royal Exchange, E.C.	1882***	Graham, James, F.F.A., Australian Widows' Fund Life Assurance Society, Collins-street-west, Melbourne, Australia.
1874***	Duncan, John, Clergy Pensions Institution and Ecclesiastical Insurance Office, 11 Norfolk-street, Strand, W.C.	1886	Gunn, Niel Ballingal, F.F.A., Scottish Amicable Life Assur. Soc., 35 St. Vincent-place, Glasgow.
1869	Dymond, Joseph John, Friends' Provident Institution, Bradford, Yorkshire.		

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1880***	Hardy, George Francis, <i>Universal Life Assurance Soc. 1 King William-street, E.C.</i>	1894***	Hutcheson, William Anderson, F.F.A., <i>Mutual Life Insurance Company of New York, Nassau-street, New York, U.S.A.</i>
1870***	Hardy, Ralph Price, <i>61 Addison-road, W.</i>	1893***	Hutton, William, F.F.A., <i>Scottish Amicable Life Assur. Soc., 1 Threadneedle-street, E.C.</i>
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1879	Harvey, Chas. J., <i>The Colonial Life Insce. Co. of America, 43 Montgomery-street, Jersey City, N.J., U.S.A.</i>	1897***	Kentish, Owen, <i>Economic Life Assurance Soc., 6 New Bridge-street, E.C.</i>
1888***	Hemming, Arthur George, F.S.S., <i>London Assurance Corporation, 7 Royal Exchange, E.C.</i>	1874***	King, George, F.F.A., Mem. Act. Soc. Amer. (HON. EDITOR OF JOURNAL), <i>London Assurance Corporation, 7 Royal Exchange, E.C.</i>
1896***	Henderson, Robert, B.A., <i>Equitable Life Assurance Soc., 120 Broadway, New York.</i>	1887***	Kyd, Thomas, F.F.A., <i>Northern Assurance Company, 1 Union-terrace, Aberdeen.</i>
1864	Hendriks, Augustus, F.S.S., Mem. Act. Soc. Amer. (PAST PRESI- DENT, 1892-94), <i>Liverpool and London and Globe Insur. Co., 7 Cornhill, E.C.</i>	1876***	Laing, Francis, F.F.A., <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
Under the Charter.	Hendriks, Frederick, F.S.S., <i>7 Vicarage-gate, Kensington, W.</i>	1882	Lancaster, William John, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1883	Hewat, Archibald, F.F.A., F.S.S., <i>Edinburgh Life Assurance Co., 22 George-street, Edinburgh.</i>	1894***	Laughton, Alexander Millar, F.F.A., <i>National Mutual Life Assoc. of Australasia, Limited, Corner of Collins and Queen-streets, Mel- bourne, Australia.</i>
1874***	Higham, Charles Daniel, Mem. Act. Soc. Amer. (PRESIDENT), <i>London Life Association Ltd., 81 King William-street, E.C.</i>	1887***	Lemon, William Kent, Barrister- at-Law, <i>5 Pump-court, E.C.</i>
1898***	Hodgson, William Horsford, <i>Law Life Assurance Society, 187 Fleet-street, E.C.</i>	1896***	Levine, Abraham, M.A. (HON. SUB-EDITOR OF JOURNAL), <i>National Mutual Life Assur. Soc., 39 King-st., Cheapside, E.C.</i>
1899***	Holliday, John, M.A., F.S.S., <i>1 Grove-road, New Southgate.</i>	1896***	Lewis, John Norman, F.F.A., <i>Scottish Widows' Fund Life Assur. Soc., 28 Cornhill, E.C.</i>
1888***	Hopkins, William Raynes, <i>London &amp; Lancashire Life Assur. Co., 66 &amp; 67 Cornhill, E.C.</i>	1892***	Lidstone, George James, <i>Alliance Assur. Co., Bartholo- mew-lane, E.C.</i>
1890***	Hovil, Lewis Frederick, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>		

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| 1899                             | Low, George Macritchie, F.F.A.,<br><i>Edinburgh Life Assurance Co.,</i><br>22 <i>George-street, Edinburgh.</i>   | 1851***                          | Meikle, James, F.F.A., Mem. Act.<br>Soc. Amer.,<br><i>Scottish Provident Institution,</i><br>6 <i>St. Andrew-sq., Edinburgh.</i>              |
| 1899***                          | Lutt, Harold Edward William,<br><i>Commercial Union Assur. Co.,</i><br>Ltd., 24, 25 & 26 <i>Cornhill, E.C.</i>   | 1897***                          | Miller, Neville,<br><i>London Assurance Corporation,</i><br>7 <i>Royal Exchange, E.C.</i>   |
| 1898***                          | Macanlay, Thomas Bassett, Pres.<br>Act. Soc. Amer.,<br><i>Sun Life Assurance Co. of</i><br><i>Canada, Montreal, Canada.</i>  | 1893***                          | Milner, John William,<br><i>North British &amp; Mercantile Insur.</i><br><i>Co., 61 Threadneedle-street, E.C.</i>                             |
| 1885                             | Mackenzie, Alexander George,<br>F.F.A.,<br><i>c/o British Empire Mutual Life</i><br><i>Assur. Co., 4 &amp; 5 King William-</i><br><i>street, E.C.</i>  | 1892***                          | Milton, Henry, M.A.,<br>37 <i>Threadneedle-street, E.C.</i>   |
| 1900***                          | Macnaghten, Steuart Edye,<br>46 <i>Brunswick-road, Brighton.</i>   | 1899***                          | Moir, Henry, F.F.A.,<br><i>Scottish Life Assur. Co., 19 St.</i><br><i>Andrew-square, Edinburgh.</i>   |
| 1870***                          | Manly, Henry William, Mem. Act.<br>Soc. Amer. (EX-PRESIDENT),<br><i>Equitable Life Assurance Soc.,</i><br><i>Mansion-house-street, E.C.</i>  | 1890***                          | Molyneux, Arthur Ernest,<br><i>Provident Clerks' Mutual Life</i><br><i>Assurance Association, 27 &amp; 29</i><br><i>Moorgate-street, E.C.</i> |
| 1898***                          | Marchbank, Frank, F.F.A.,<br><i>Royal Exchange Assur. Corp.,</i><br>8 <i>Mosley-st., Newcastle-on-Tyne.</i>  | 1897***                          | Moors, Elphinstone MacMahon,<br>M.A.,<br><i>University of Sydney, Australia.</i>  |
| 1890***                          | Marks, Geoffrey (HONORARY<br>LIBRARIAN),<br><i>National Mutual Life Assur. Soc.,</i><br>39 <i>King-street, Cheapside, E.C.</i>   | 1896***                          | Moran, Joseph Flack,<br><i>Marine &amp; General Mutual Life</i><br><i>Assurance Society, 14 Leaden-</i><br><i>hall-street, E.C.</i>           |
| 1900***                          | Marr, Vyvyan, F.F.A.,<br><i>Edinburgh Life Assurance Co.,</i><br>22 <i>George-street, Edinburgh.</i>   | 1900***                          | Morgan, Benjamin Charles, M.A.,<br><i>Commercial Union Assur. Co.,</i><br>24, 25 & 26 <i>Cornhill, E.C.</i>                                   |
| 1897***                          | May, George Ernest,<br><i>Prudential Assurance Company,</i><br><i>Holborn-bars, E.C.</i>   | 1895***                          | Muter, Percy,<br><i>New Zealand Government Life</i><br><i>Insurance Department Wel-</i><br><i>lington, New Zealand.</i>                       |
| 1875                             | McCabe, William, LL.B., F.S.S.,<br>Mem. Act. Soc. Amer.,<br><i>North American Life Assur. Co.,</i><br><i>North American Life Building,</i><br>112-118 <i>King-st.-west, Toronto,</i><br><i>Canada.</i> | 1888***                          | Nash, Willie Oscar,<br><i>Law Reversionary Interest Soc.,</i><br>Ltd., 24 <i>Lincoln's-inn-fields, W.C.</i>                                   |
| 1874                             | McClintock, Emory, Mem. Act.<br>Soc. Amer.,<br><i>Mutual Life Insurance Company</i><br><i>of New York, New York.</i>   | 1883                             | Neison, Francis G. P., F.S.S.,<br>19 <i>Abingdon-st., Westminster, S.W.</i>   |
| 1894***                          | McDonald, John,<br><i>Prudential Assurance Company,</i><br><i>Holborn-bars, E.C.</i>   | 1888***                          | Newman, Philip Lewin, B.A.,<br><i>Yorkshire Insurance Co., York.</i>  |
| 1864                             | McGedy, Frank,<br><i>Clifford Lodge, Crescent-road,</i><br><i>Worthing.</i>  | 1848                             | Newman, William Lewin,<br>22 <i>St. Paul's-square, York.</i>  |
| 1883***                          | McGowan, James, B.A.,<br><i>The Treasury, Cape Town.</i>   | 1865                             | Newton, Algernon, M.A.,<br><i>c/o London &amp; Westminster Bank,</i><br>94 & 96 <i>High-st., Kensington, W.</i>                               |
|                                  |  | 1857***                          | Nightingale, Harry Ethelston,<br><i>Royal Exchange Assurance Cor-</i><br><i>poration, Royal Exchange, E.C.</i>                                |
|                                  |  | 1899***                          | Parker, Robert Peter,<br><i>Sun Life Assurance Society,</i><br>63 <i>Threadneedle-street, E.C.</i>  |

## FELLOWS.

Those marked \*\*\* have passed the Examination for the Class of Fellow.

Date of becoming a Fellow.		Date of becoming a Fellow.	
1864	Pearson, Arthur, <i>Betchworth-house, The Bank, Highgate, N.</i>	1881***	Somerville, William Finlay, <i>Liverpool and London and Globe Insurance Co., 7 Cornhill, E.C.</i>
1891***	Phelps, William Peyton, M.A., <i>Equity and Law Life Assur. Soc., 18 Lincoln's-inn-fields, W.C.</i>	1877***	Sorley, James, F.F.A., C.A., F.R.S.E., <i>Pelican Life Insurance Company, 70 Lombard-street, E.C.</i>
Under the Charter.	Priestley, John George, <i>44 St. German's-road., Forest-hill, S.E.</i>	1898***	Spencer, John, <i>English and Scottish Law Life Assurance Assoc., 12 Waterloo-place, S.W.</i>
1891***	Pulley, William Pritchard, <i>Norwich Union Life Insur. Soc., 71 &amp; 72 King William-st., E.C.</i>	1894***	Sprague, Alfred Ernest, B.Sc., M.A., F.F.A., <i>Scottish Equitable Life Assur. Society, 28 St. Andrew-square, Edinburgh.</i>
1899***	Raisin, Arthur Herbert, <i>Pelican Life Ins. Co., 70 Lombard-street, E.C.</i>	1857	Sprague, Thomas Bond, M.A., LL.D., F.F.A., F.S.S., F.R.S.E. (PAST PRESIDENT, 1882-86), <i>Scottish Equitable Life Assur. Society, 28 St. Andrew-square, Edinburgh.</i>
1897***	Rees, Martin, <i>Law Reversionary Interest Soc., Ltd., 24 Lincoln's-inn-fields, W.C.</i>	1896***	Stahlschmidt, Louis, <i>Imperial Life Insurance Co., 1 Old Broad-street, E.C.</i>
1898***	Robinson, George Frederick, <i>Legal and General Life Assur. Society, 10 Fleet-street, E.C.</i>	Under the Charter.	Stephenson, John Ware, <i>186 Clapham-road, S.W.</i>
1888***	Rusher, Edward Arthur, F.S.S., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	Under the Charter.	Stevens, Charles, <i>Aberdeen Ho., Preston, Brighton.</i>
1882***	Ryan, Gerald Hemmington (VICE-PRESIDENT), Mem. Act. Soc. Amer., <i>British Empire Mutual Life Assurance Co., 4 &amp; 5 King William-street, E.C.</i>	1888	Stewart, John, F.F.A., <i>City of Glasgow Life Assur. Co., 30 Renfield-street, Glasgow.</i>
1898***	Salmon, Richard George, F.S.S., <i>Sun Life Assurance Society, 63 Threadneedle-street, E.C.</i>	1898	Stirling, Robert, F.F.A., <i>Law Union &amp; Crown Insurance Co., 126 Chancery-lane, W.C.</i>
1883	Saunders, Harris Charter Lindon, F.R.A.S., <i>28 Holland-road, Kensington, W.</i>	1868***	Strachan, Thomas Young, F.C.A., <i>1 Savoy-mansions, Savoy-st., W.C.</i>
1886***	Schooling, Frederick (HON. SEC.), <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1892***	Straker, Edward Robert, <i>British Empire Mutual Life Assurance Co., 4 &amp; 5 King William-street, E.C.</i>
1896***	Sim, William Abernethy, F.F.A., <i>Scottish Union and National Insurance Co., 35 St. Andrew-square, Edinburgh.</i>	1878***	Straker, Frank Arthur, <i>Legal and General Life Assur. Society, 10 Fleet-street, E.C.</i>
1886***	Simon, Louis Michael, <i>Metropolitan Life Assur. Society, 13 Moorgate-street, E.C.</i>	1884***	Stuart, John Moody, F.F.A., <i>The Leeds Permanent Building Society, Victoria-buildings, Park-lane, Leeds.</i>
1875***	Smither, Arthur, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>	1900***	Sutherland, John, M.A., <i>Temperance &amp; General Mutual Life Assur. Soc., Swanston-street, Melbourne, Australia.</i>



## FELLOWS.

Those marked \*\*\* have passed the Examination for the Class of Fellow.

- | Date of becoming a Fellow.  | Date of becoming a Fellow.  |
|---|---|
| 1889***Tarn, Arthur Wyndham,<br><i>Westminster and General Life Assurance Association, 28 King-street, Covent-garden, W.C.</i>      | 1878 Turnbull, Andrew Hugh, F.F.A.,<br>F.R.S.E.,<br><i>Scottish Widows' Fund Life Assur. Soc., 9 St. Andrew-square, Edinburgh.</i>                                      |
| 1887 Teece, Richard, F.F.A., F.S.S.,<br>Mem. Act. Soc. Amer.,<br><i>Australian Mutual Provident Society, Sydney, Australia.</i>     | Under the Charter. Tyndall, William Henry, F.S.S.,<br>F.R.Met.S.,<br><i>Morlands, Oxford-road, Redhill, Surrey.</i>   |
| 1872 Templeton, Col. John M., C.M.G.,<br><i>National Mutual Life Association of Australasia, Melbourne, Australia.</i>              | 1889 Wallace, Thomas, F.F.A.,<br><i>North British &amp; Mercantile Insurance Co., Edinburgh.</i>  |
| 1886 Tennant, John Bell,<br><i>Friends' Provident Institution, Bradford, Yorkshire.</i>   | 1888***Warner, Samuel George,<br><i>Law Union &amp; Crown Insur. Co., 126 Chancery-lane, W.C.</i>   |
| 1864***Terry, James,<br><i>Hernlee, Lyme Regis, Dorset.</i>   | 1893***Watson, Alfred William,<br><i>Manchester Unity Friendly Soc., Nottingham.</i>  |
| 1889***Thiselton, Herbert Cecil, F.F.A.,<br>Mem. Act. Soc. Amer.,<br><i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i> | 1895***Watson, James Douglas,<br><i>English &amp; Scottish Law Life Assr. Assoc., 12 Waterloo-place, S.W.</i>   |
| 1893***Thomas, Ernest Charles,<br><i>Gresham Life Assurance Society, St. Mildred's-house, Poultry, E.C.</i>                         | 1880***Whittall, Wm. Joseph Hutchings,<br>Mem. Act. Soc. Amer.,<br><i>Clerical, Medical &amp; General Life Assur. Soc., 15 St. James's-sq., S.W.</i>                    |
| 1899***Thomas, Robert Arthur Caradoc,<br><i>British Empire Mutual Life Assur. Co., 4 &amp; 5 King William-street, E.C.</i>          | 1864 Wilson, Robert,<br><i>44 Talfourd-rd., Camberwell, S.E.</i>  |
| 1895***Thomson, Herbert Archer, B.A.,<br><i>Parkwood House, Whetstone, N.</i>   | 1888***Wilson, Robert, Jun.,<br><i>General Assurance Company, 103 Cannon-street, E.C.</i>   |
| 1880 Thomson, Robert,<br><i>Colonial Mutual Life Assurance Society, Collins-street-west, Melbourne, Australia.</i>                  | Under the Charter. Winsor, Thomas Boorman,<br><i>81 Shooter's-hill-road, Blackheath, S.E.</i>   |
| 1876 Thomson, Spencer Campbell, B.A.,<br>F.F.A.,<br><i>Standard Life Assurance Co., 3 George-street, Edinburgh.</i>                 | 1899***Winter, Arthur Thomas,<br><i>The British Empire Mutual Life Assurance Company, 1A Hare-street, Calcutta.</i>   |
| 1893***Thorne, Alfred Charles,<br><i>Equity &amp; Law Life Assur. Soc., 18 Lincoln's-inn-fields, W.C.</i>                           | 1897***Wintle, Lancelot Andrewes,<br><i>Economic Life Assurance Soc., 6 New Bridge-street, E.C.</i>   |
| 1891***Tilt, Robert Ruthven,<br><i>General Reversionary &amp; Investment Co., Ltd., 26 Pall-mall, S.W.</i>                          | 1884***Woods, Ernest, Mem. Act. Soc. Amer. (HON. SECRETARY),<br><i>Westminster and General Life Assur. Assoc., 25 King-street, Covent-garden, W.C.</i>                  |
| 1881***Todd, George, M.A.,<br><i>Economic Life Assurance Society, 6 New Bridge-street, E.C.</i>                                     | 1875***Wyatt, Frank Bertrand, Mem. Act. Soc. Amer. (VICE-PRESIDENT),<br><i>Clergy Mutual Assurance Soc., 2 &amp; 3 The Sanctuary, S.W.</i>                              |
| 1894***Todhunter, Ralph, M.A.,<br><i>University Life Assur. Soc., 25 Pall-mall, S.W.</i>  | 1874 Young, Thomas Emley, B.A.,<br>F.R.A.S. (PAST-PRESIDENT, 1896-8), Mem. Act. Soc. Amer.,<br><i>Commercial Union Assur. Co., Ltd., 24, 25 &amp; 26 Cornhill, E.C.</i> |
| 1899***Trouncer, Harold Moltke, B.A.,<br><i>London Life Association Ltd., 81 King William-street, E.C.</i>                          |   |



## ASSOCIATES.

Those marked \* have passed the first of the three parts of the Examination for the Class of Fellow. Those marked \*\* have passed two of the three parts of the Examination for the Class of Fellow, those marked \*\*a or \*\*b, have also passed either Section A or Section B of Part III of the Examination.

Date of becoming an Associate.		Date of becoming an Associate.	
1900**	Adams, Cecil Francis, <i>Ocean Accident and Guarantee Corporation, Ltd., Wellington, New Zealand.</i>	1889	Bremner, Thomas William, F.F.A., <i>Mutual Life Insurance Co. of New York, Sydney, Australia.</i>
1869**	Adey, Theodore Henry, <i>Scottish Provident Institution, 17 King William-street, E.C.</i>	1878**	Bridgman, Arthur Henry, <i>Equity &amp; Law Life Assur. Soc., 18 Lincoln's-inn-fields, W.C.</i>
1899**a	Adlard, Howard Tindale, A.K.C., <i>The Equitable Life Assurance Society, Mansion-house-st., E.C.</i>	1899**	Brown, Harold, <i>Scottish Union and National Insurance Co., 3 King William-street, E.C.</i>
1899**	Adlard, Stanley, A.K.C., <i>London Life Association Ltd., 81 King William-street, E.C.</i>	1900**	Brown, Henry, B.A., <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>
1899**	Anderson, Thomas Frederic, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>	1898**b	Brown, Hugh Wylie, F.F.A., <i>Scottish Union &amp; National Insur. Company, 35 St. Andrew-square, Edinburgh.</i>
1899**	Ansell, George Frederic, <i>National Debt Office, 19 Old Jewry, E.C.</i>	1896	Brown, George Andrew, <i>Clerical, Medical &amp; General Life Assurance Society, 15 St. James's-square, S.W.</i>
1898**	Appleton, Frederick, <i>London Life Association Ltd., 81 King William-street, E.C.</i>	1898**b	Buchanan, James, M.A., <i>Scottish Widows' Fund Life Assurance Society, 9 St. Andrew-square, Edinburgh.</i>
1883**	Ashley, John Geo., M.A., <i>War Office, Pall Mall, S.W.</i>	1886	Buckley, Thomas John Wesley, <i>9 St. Andrew-street, Holborn-circus, E.C.</i>
1899**a	Austin, Herbert Henry, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1882	Burke, David, F.S.S., <i>Royal Victoria Life Insur. Co., Montreal, Canada.</i>
1881**	Ayling, Charles Stephen, <i>Commercial Union Assur. Co., 20 New Bridge-street, E.C.</i>	1900**	Burnley, Isaac, <i>Australian Mutual Prov. Society, Wellington, New Zealand.</i>
1885	Barton, Arthur, <i>United Kent Insurance Institution, Maidstone.</i>	1895**	Butterfield, William Thos., A.C.A., <i>29 Pearl-buildings, 19 Market-street, Bradford.</i>
1894**a	Barton, Robert Whitchurch, <i>Clerical, Medical &amp; General Life Assurance Society, 15 St. James's-square, S.W.</i>	1876*	Carter, Eric Mackay, <i>33 Waterloo-street, Birmingham.</i>
1881	Birks, Edmund Alfred, <i>Yorkshire Insurance Co., York.</i>	1899**	Catchlove, Chas. Hamilton Leyland, <i>Australian Mutual Provident Society, Adelaide, S. Australia.</i>
1873**	Bloek, Robert John, <i>Essex - villa, Chelsham - road, Clapham, S.W.</i>	1900**	Chandler, Thomas Richard, <i>London Assurance Corporation, 7 Royal Exchange, E.C.</i>
1898	Blount, Edward Thos. J., F.F.A., F.S.S., <i>Standard Life Assurance Co., Shanghai, China.</i>	1898**	Coates, Thomas Linnaeus, <i>North British and Mercantile Insurance Co., 61 Threadneedle-street, E.C.</i>
1873**	Boon, Gerald Inglis, <i>Law Accident Insurance Society, 215 Strand, London.</i>		
1861	Bourne, James Pearce, <i>c/o Messrs. Lewis &amp; Mounsey, 3 Lord Street, Liverpool.</i>		

## ASSOCIATES.

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Date of becoming an Associate		Date of becoming an Associate.	
1871	Cook, Arthur James, M.J.I., <i>Victoria Mutual Assur. Society</i> <i>Farringdon-street, E.C.</i>	1881	Dovey, William Roadly, F.F.A., Mem. Act. Soc. Amer., <i>Citizens' Life Assurance Co.,</i> <i>Castlereagh-st., Sydney, Australia</i>
1899**b	Cook, William Playfair, <i>Guardian Assurance Company,</i> <i>11 Lombard-street, E.C.</i>	1870*	Dowson, John, <i>Royal Insur. Company, Liverpool.</i>
1878	Cooke, George, <i>Commercial Union Assur. Co.,</i> <i>Ltd., 24, 25 &amp; 26 Cornhill, E.C.</i>	1898**	Doyle, Arthur James, <i>54 Bourke-st., Sydney, Australia.</i>
1897**	Coop, Charles Rowland, <i>United Kingdom Temperance and</i> <i>General Provident Institution,</i> <i>5 Bennett's-hill, Birmingham.</i>	1868*	Eaton, Henry William, <i>Liverpool and London and Globe</i> <i>Insurance Company, William-</i> <i>street, New York, U.S.A.</i>
1891**	Cootte, Ernest Charles, <i>Alliance Assurance Company,</i> <i>Bartholomew-lane, E.C.</i>	1899**b	Elderton, William Palin, <i>Guardian Assurance Company,</i> <i>11 Lombard-street, E.C.</i>
1900**	Corbett, Edwin Somerville, <i>The Standard Life Assoc., Ltd.,</i> <i>Melbourne, Australia.</i>	1872**	Evans, William, F.F.A., F.R.S.E., <i>38 Morningside-park, Edinburgh.</i>
1897**a	Countts, Charles Ronald Vawdrey, <i>Hand-in-Hand Insur. Society,</i> <i>26 New Bridge-street, E.C.</i>	1896**	Featherstonehaugh, William Irwin, <i>Commercial Union Assurance</i> <i>Co., 24, 25 &amp; 26 Cornhill, E.C.</i>
1871	Countts, Edwin Arthur, <i>North British and Mercantile</i> <i>Insurance Company, Victoria-</i> <i>street, Nottingham.</i>	1897**	Findlay, Alexander Wynaud, L.L.B., <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>
1900**	Covington, Oliver Henry, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>	1881	Fisher, Frederick, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>
1884	Craig, Robert Alexander, <i>Abstainers' and General Assur.</i> <i>Co., City Buildings, Birmingham.</i>	1890	Fox, Charles Edward, F.F.A., <i>Standard Life Assurance Co.,</i> <i>83 King William-street, E.C.</i>
1900**	Curtis, William Allen, <i>Clerical, Medical &amp; General</i> <i>Life Assurance Society, 15 St.</i> <i>James's-square, S.W.</i>	1886	Fox, Morris, Mem. Act. Soc. Amer., <i>New Zealand Government Life</i> <i>Insur. Dept., Wellington, N.Z.</i>
1884	Dell, Vincent John (AUDITOR), <i>Equitable Life Assur. Society,</i> <i>Mansion-house-street, E.C.</i>	1894**	Fraser, Thomas John, <i>Australian Alliance Assurance</i> <i>Company, Melbourne, Australia.</i>
1900**	Diver, Oswald Francis, <i>Clerical, Medical &amp; General Life</i> <i>Assur. Soc., 15 St. James'-sq., S.W.</i>	1873**	Gage, Uriah Woodard, <i>Universal Life Assur. Society,</i> <i>1 King William-street, E.C.</i>
1855	Dix, James, <i>Hurstdale, Wood-la., Highgate, N.</i>	1897**	Galer, Frederic Bertram, B.A., <i>Rock Life Assurance Company,</i> <i>15 New Bridge-street, E.C.</i>
1881	Donaldson, John, <i>Australian Widows' Fund Life</i> <i>Assurance Society, Collins-street-</i> <i>west, Melbourne, Australia.</i>	1895**	Galwey, Charles Edmund, <i>New Zealand Government Life</i> <i>Insurance Dept., Wellington,</i> <i>New Zealand.</i>
1899**	Dougharty, Harold, F.S.S., <i>London &amp; Lancashire Life Assur.</i> <i>Company, 66 &amp; 67 Cornhill, E.C.</i>	1893**	Gardiner, Robert Edward, <i>Sun Life Assurance Society, 63</i> <i>Threadneedle-street, E.C.</i>
		1885**	Gayford, Herbert Stannard, <i>Northern Assurance Co., 15</i> <i>Victoria-street, Nottingham.</i>

## ASSOCIATES.

Those marked \* have passed the first of the three parts of the Examination for the Class of Fellow. Those marked \*\* have passed two of the three parts of the Examination for the Class of Fellow; those marked \*\*a, or \*\*b, have also passed either Section A or Section B of Part III of the Examination.

Date of becoming an Associate.	Date of becoming an Associate.
1899** <sup>b</sup> Gibb, James Burnett, F.F.A., <i>Penn Mutual Life Insce. Co. of Philadelphia, 923 Chestnut-st., Philadelphia, U.S.A.</i>	1896** <sup>a</sup> Harris, Frederick Joseph, <i>Australian Mutual Provident Society, Sydney, Australia.</i>
1897** Gillies, George, <i>Union Ins. Soc., 81 Cornhill, E.C.</i>	1897** Haycraft, William Melhuish, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1871** Glennie, William Gordon, <i>Scottish Union &amp; National Insur. Co., 3 King William-street, E.C.</i>	1897** Hazell, James Stanley, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>
1895** <sup>a</sup> Glover, Henry Walter, <i>Pullinger House, Beaconsfield, Cape Colony.</i>	1895** Heness, Leonard Thomas, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1897** Goggs, Frank Sidney, <i>Scottish Metropolitan Life Assur. Co., 25 St. Andrew-sq., Edinburgh.</i>	1878 Henry, Alfred, F.C.A., <i>Throgmorton-house, Copthall-avenue, E.C.</i>
1882 Goldman, Leopold, <i>North American Life Assurance Co., North American Life Building, 112-118 King-street-west, Toronto, Canada.</i>	1900** Hicks, Arthur Joseph, <i>Reversionary &amp; General Securities Company, Ltd., Craven House, Northumberland-avenue, W.C.</i>
1897** Goodwyn, John, Jun., <i>Norwich and London Accident Insurance Assoc., 1 Lakenham-terrace, Norwich.</i>	1884 Higham, William Samuel, <i>Equitable Life Assurance Soc., Mansion-house-street, E.C.</i>
1899** <sup>b</sup> Gordon-Smith, Randolph, F.F.A., <i>Scottish Amicable Life Assur. Society, 35 St. Vincent-place, Glasgow.</i>	1894** Hollingworth, Albert Chas., <i>Australian Mutual Provident Society, Sydney, Australia.</i>
1888 Gray, John, <i>Scottish Widows' Fund Life Assur. Society, 28 Baldwin-st., Bristol.</i>	1883 Holt, Edward Hallett, <i>Law Life Assurance Society, 187 Fleet-street, E.C.</i>
1898** Green, George, B.A., <i>Union Insurance Society, 81 Cornhill, E.C.</i>	1894** Home, Noel Charles Minchin, <i>LL.B., F.S.S., 5 King's Bench-walk, Temple, E.C.</i>
1868* Greig, John Andrew, <i>Sun Life Assurance Society, 60 Charing-cross, S.W.</i>	1898** Howell, Chas. Edward, B.A., LL.D., <i>Standard Life Assurance Comp., 66 Upper Sackville-st., Dublin.</i>
1869 Griffith, E. Clifton, <i>4 Carlton-chambers, S.W.</i>	1899** Hudson, Alfred James, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1893** Hall, John Francis Edmund, <i>Eagle Insurance Company, 79 Pall-mall, S.W.</i>	1875 Hunt, Richard Aldington, F.S.S., <i>Wesleyan &amp; General Assur. Soc., Corporation-street, Birmingham.</i>
1869 Hann, Robert George, Mem. Act. Soc. Amer., <i>The Equitable Life Assur. Soc., 120 Broadway, New York.</i>	1893 Hunter, Arthur, F.F.A., <i>New York Life Insurance Co., 346 &amp; 348 Broadway, New York.</i>
1894** Hardcastle, Edwd. Edgington, M.A., <i>Union Central Life Office, Cincinnati, Ohio, U.S.A.</i>	1887** Hunter, Samuel, <i>Patriotic Assurance Company, 9 College-green, Dublin.</i>
1900** Harding, Harry Burnard, <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>	1900** Hurst, Henry Alexander, <i>485 Bury New-road, Kersal, Manchester.</i>
	1889 Jacobs, Frederick Job, <i>Australian Mutual Provident Society, Sydney, Australia.</i>

## ASSOCIATES.

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Date of becoming an Associate.		Date of becoming an Associate.	
1876**	James, George Trevelyan, 12 Waterloo-place, s.w.	1899**	Lawton, George Herbert, Clerical, Medical & General Life Assur.Soc., 15 St. James's-sq., s.w.
1871	Jellicoe, George Rogers, Eagle Insurance Company, 79 Pall-mall, s.w.	1885	Ledward, Archibald Prentice, B.Sc., Scottish Provident Institution, 10 Albert-square, Manchester.
1883	Jerman, Richard, Commercial Union Assurance Company, Exeter.	1879	Leitch, Alexander, Scottish Provident Institution, 17 King William-street, E.C.
1896**	Jobson, Alexander, Australian Mutual Provident Society, Melbourne.	1897**	Le Maitre, Frank William, Sun Life Assurance Society, 63 Threadneedle-street, E.C.
1894**	Johannessen, Nikolai Mikal, Hygea Life Assurance Company, Bergen, Norway.	1885	Leveaux, Arthur Michael, F.S.S., Registry of Friendly Societies, Central Office, 28 Abingdon- street, Westminster, s.w.
1894**	Johnston, Frederick H., Prudential Life Insurance Co. of America, Newark, N.J., U.S.A.	1885**	Lidbury, Isaac Stephen, Prudential Assurance Company, Holborn-bars, E.C.
1870	Joyce, Septimus. 24 Bridge-street, Bristol.	1868*	Litchfield, Edward, Lancashire Insurance Company, 25 Pine-st., New York, U.S.A.
1898**	Kaufman, Henry N., Assoc. Act. Soc. Amer., Phoenix Mutual Life Insurance Co., Hartford, Connecticut.	1897**a	Little, James Fulton, Mutual Life Association of Aus- tralia, Sydney, Australia.
1876	Kearry, Joseph, 143 Broomwood-road, Wands- worth-common, s.w.	1894**a	Lowndes, Arthur, Royal Exchange Assurance Cor- poration, Royal Exchange, E.C.
1899**	Kelly, John Joseph, Citizens' Life Assurance Co., Sydney, Australia.	1876**	Lucey, Herbert, General Assurance Company, 103 Cannon-street, E.C.
1897**	Kemp, Julian Ernest Sandford, Eagle Insurance Company, 79 Pall-mall, s.w.	1890	Lugton, Hugh, F.F.A., North British and Mercantile Insurance Co., 61 Threadneedle- street, E.C.
1858	Kilford, George William, Rue de Grétry, Paris.	1867*	Macdonald, William Rae, F.F.A., Scottish Metropolitan Life Assur. Co., 25 St. Andrew-sq., Edinburgh.
1874*	King, Arthur Thomas, National Debt Office, 19 Old Jewry, E.C.	1884	Mackay, Alexander (AUDITOR), Law Union & Crown Insur. Co., 126 Chancery-lane, w.c.
1882**	King, William Alfred, Northern Assurance Company, 1 Moorgate-street, E.C.	1896**	Macmillan, John Campbell, Royal Insurance Co., Apartado Postal No. 657, Mexico.
1861	Knowles, Richard, 35 Tilson-road, Tottenham, N.	1895**a	Macphail, Donald, F.F.A., Yorkshire Insurance Company, York.
1893**	Laing, William Cland, 128 Stroud Green-road, N.	1867	Macpherson, Ronald, Law Union & Crown Insurance Co., 126 Chancery-lane, w.c.
1897**	Lane, Arthur Vere, B.A., Gresham Life Assurance Society, St. Mildred's-house, Poultry, E.C.		



## ASSOCIATES.

Those marked \* have passed the first of the three parts of the Examination for the Class of Fellow. Those marked \*\* have passed two of the three parts of the Examination for the Class of Fellow; those marked \*\*a, or \*\*b, have also passed either Section A or Section B of Part III of the Examination.

Date of becoming an Associate.	Date of becoming an Associate.
1883** Makeham, William Reed, <i>Imperial Life Insurance Co.,</i> 1 Old Broad-street, E.C.	1879* Monilaws, William MacGeorge, <i>Scottish Provident Institution,</i> 6 St. Andrew-sq., Edinburgh.
1883 Mannering, George Willsher, <i>London &amp; Lancashire Life Assur. Co.,</i> 66 and 67 Cornhill, E.C.	1892** Moodie, Peter Boyd, <i>Scottish Office, Whitehall,</i> S.W.
1880* Manwaring, Henry, <i>National Debt Office,</i> 19 Old Jewry, E.C.	1877 Moon, James, <i>Prudential Assurance Company,</i> 30 Dale-street, Liverpool.
1878 Marshall, William, <i>South African Mutual Life Assur. Soc.,</i> Cape Town, South Africa.	1877 Moon, John, <i>Prudential Assurance Company,</i> 76 King-street, Manchester.
1896** Martin, Sidney George, <i>National Mutual Life Assoc. of Australasia, Ltd.,</i> 150 Queen-street, Brisbane, Australia.	1879* Moon, Sidney Norman Laming, <i>The Ocean Accident &amp; Guarantee Corp.,</i> 346-348, Broadway, N.Y.
1897** Mascall, Alfred John, <i>Standard Life Assurance Co.,</i> 3 Pall-mall East, S.W.	1898** Moore, Joseph Patrick, <i>Citizens' Life Assurance Co.,</i> Sydney, Australia.
1900** Maunder, George Harvard, <i>Imperial Life Insurance Co.,</i> 1 Old Broad-street, E.C.	1871** Moore, Roderick Mackenzie, <i>United Kingdom Temperance and General Provident Institution,</i> 1 Adelaide-place, London-bridge, E.C.
1898** May, Basil, <i>Gilamont, Maple-road, Surbiton.</i>	1896**a Moorhouse, Alfred, <i>Friends' Provident Institution,</i> Bradford.
1900** McArthur, Harry de C., <i>Economic Life Assur. Society,</i> 6 New Bridge-street, E.C.	1893** Munro, Donald Alexander, <i>Africa House,</i> 44-46 Leadenhall-street, E.C.
1882** McDougald, Alfred, <i>British Empire Mutual Life Assur. Co.,</i> Montreal, Canada.	1900** Nash, Alfred Charles, <i>Clerical, Medical and General Life Assurance Society,</i> 15 St. James's-square, S.W.
1881 McKenzie, Duncan John McGregor, <i>New Zealand Government Life Insur. Department,</i> Wellington, New Zealand.	1897** Newling, Sidney Wallis, B.A., <i>Woodleigh, South Woodford,</i> Essex.
1899** Meade, Gerald Willoughby, <i>North British &amp; Mercantile Insurance Company,</i> 61 Thread-needle-street, E.C.	1884 Nicoll, John, F.F.A., <i>Life Association of Scotland,</i> 82 Princes-street, Edinburgh.
1896** Merfield, Percy Henry, <i>Law Life Assurance Society,</i> 187 Fleet-street, E.C.	1897** Norris, Charles Arthur, <i>National Mutual Life Assoc. of Australasia, Ltd.,</i> Melbourne, Australia.
1874 Miller, John W., F.S.S., <i>Scottish Widows' Fund Life Assur. Soc.,</i> 28 Cornhill, E.C.	1900**b Norton, William Ernest, <i>National Provident Institution,</i> 48 Gracechurch-street, E.C.
1884 Mills, Daniel Yarnton, <i>Scottish Equitable Life Assur. Society,</i> 26 St. Andrew-square, Edinburgh.	1900** Oakley, Henry John Percy, <i>North British and Mercantile Insurance Company,</i> 61 Thread-needle-street, E.C.



## ASSOCIATES.

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Date of becoming an Associate.		Date of becoming an Associate.	
1883	Orr, Lewis P., F.F.A., <i>Scottish Life Assur. Co., Ltd.,</i> <i>19 St. Andrew-sq., Edinburgh.</i>	1880	Povah, Charles, <i>Lancashire Insurance Co., 18</i> <i>Exchange-street, Manchester.</i>
1886	Owen, Evan Frederick, F.S.S., * <i>Actuary for Friendly Societies,</i> <i>Melbourne, Australia.</i>	1890**	Powell, Alfred, <i>Alliance Assurance Company,</i> <i>Bartholomew-lane, E.C.</i>
1895**	Pagden, Lionel King (AUDITOR), <i>Union Insurance Society, 81</i> <i>Cornhill, E.C.</i>	1881*	Price, William John, <i>Life Association of Scotland, 5</i> <i>Lombard-street, E.C.</i>
1864	Panton, Edward Henry, <i>Standard Life Assurance Co.,</i> <i>83 King William-street, E.C.</i>	1869*	Pringle, James, C.A., F.F.A., <i>42 Drumsheugh-gardens, Edin-</i> <i>burgh.</i>
1895**	Paradice, William Henry, <i>Australian Mutual Provident</i> <i>Society, Sydney, Australia.</i>	1884	Pullar, James, F.F.A., <i>Colonial Mutual Life Assurance</i> <i>Society, Melbourne, Australia.</i>
1869*	Park, David Francis, C.A., F.F.A., <i>Crédit Foncier of Mauritius</i> <i>(Limited), 39 Lombard-st., E.C.</i>	1881	Purves, Thomas Peter, <i>New York Life Insurance Com-</i> <i>pany, Sydney, Australia.</i>
1884	Park, Leslie John, <i>Colonial Mutual Life Assurance</i> <i>Society, Melbourne, Australia.</i>	1899**	Rae, Joseph, <i>Finance Department, Vestry-</i> <i>hall, Upper-street, N.</i>
1882**	Paterson, William Broekie, F.F.A., <i>Mem. Act. Soc. Amer.,</i> <i>Norwich Union Life Insurance</i> <i>Society, Norwich.</i>	1867	Rattray, Patrick, C.A., <i>Gresham House, 45 West Nile-</i> <i>street Glasgow.</i>
1898	Pearce, Henry John, F.F.A., <i>Edinburgh Life Assurance Co.,</i> <i>122 St. Vincent-street, Glasgow.</i>	1874**	Ray, Charles Richard, <i>Hand-in-Hand Insurance Soc.,</i> <i>26 New Bridge-street, E.C.</i>
1899**	Peele, Thomas, <i>Refuge Assurance Company,</i> <i>Oxford-street, Manchester.</i>	1885*	Rea, Charles Herbert Edmund, <i>F.R.A.S., F.S.S.,</i> <i>3 &amp; 4 Clement's-inn, W.C.</i>
1875	Perratt, William Henry, <i>4 Finsbury-circus, E.C.</i>	1894**a	Reeve, Charles Ernest, <i>Royal Exchange Assurance Cor-</i> <i>poration, Royal Exchange, E.C.</i>
1900**	Peters, Charles Furness, <i>L'pool, Victoria Legal Friendly</i> <i>Society, 18 St. Andrew-street, E.C.</i>	1898**	Reid, Edward E., B.A., <i>London Life Insurance Co.,</i> <i>London, Ontario.</i>
1895	Pierson, Israel Coriell, Mem. Act. <i>Soc. Amer.,</i> <i>141 Broadway, New York,</i> <i>U.S.A.</i>	1887	Richardson, Josephus Hargreaves, <i>F.F.A., Mem. Act. Soc. Amer.,</i> <i>New Zealand Government Life</i> <i>Insurance Department, Wel-</i> <i>lington, New Zealand.</i>
1899**	Pipe, Sidney Herbert, <i>Pearl Life Assurance Company,</i> <i>London-bridge, E.C.</i>	1900**	Richmond, George William, <i>Scottish Widows' Fund Life</i> <i>Assur. Society, 28 Cornhill, E.C.</i>
1883	Pitts, Thomas, <i>Commercial Union Assurance</i> <i>Company, Exeter.</i>	1879	Roberts, Thomas B., <i>Australian Alliance Assurance</i> <i>Company, Collins-street, Mel-</i> <i>bourne, Australia.</i>
1876*	Pound, Thomas James, <i>Clerical, Medical &amp; General Life</i> <i>Assurance Soc., 15 St. James's-</i> <i>square, S.W.</i>	1878	Robertson, William, F.F.A., <i>54 Queen-street, Edinburgh.</i>

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Date of becoming an Associate.		Date of becoming an Associate.	
1876*	Robinson, Andrew, <i>Sunningdale-park, Sunningdale, Berks.</i>	1897**	Shimmell, James Edward, <i>Scottish Imperial Insurance Co., 183 West George-st., Glasgow.</i>
1885	Ronald, Thomas Robert, <i>Law Guarantee and Trust Soc., Ltd., 49 Chancery Lane, W.C.</i>	1896**	Shlager, Joseph, <i>Mutual Assurance Society, Melbourne, Australia.</i>
1897**	Ryley, Edmund, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1897**	Slade, Henry, <i>24 Durand-gardens, Clapham-road, S.W.</i>
1899**	Salter, Charles Henry, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>	1864*	Smith, Howard Samuel, F.F.A., F.S.S., F.C.A., <i>Bank-chambers, 14 Waterloo-street, Birmingham.</i>
1896**	Sanderson, Frank, M.A., F.S.S., Mem. Act. Soc. Amer., <i>Canada Life Assurance Company, Toronto, Canada.</i>	1898**	Smith, Robert Parker, <i>Lancashire Insurance Company, 18 Exchange-street, Manchester.</i>
1884	Schooling, John Holt, <i>Fotheringay-house, Montpelier-row, Twickenham.</i>	1884	Smithett, Edward Henry, <i>"Hillside," Fitzroy-park, High-gate, N.</i>
1899**	Schouten, Pieter, <i>Algemeene Maatschappij van Levensverzekering en Lijfrente, Damrak, 74, Amsterdam.</i>	1863**	Smyth, Edward, <i>60 Wiltshire-road, Brixton, S.W.</i>
1873	Scott, Ernest Willem, Mem. Act. Soc. Amer., <i>Algemeene Maatschappij van Levensverzekering en Lijfrente, Damrak, 74, Amsterdam.</i>	1871	Spencer, Robert James, F.S.S., <i>75 King's-road, Southsea.</i>
1895**a	Searle, George Morley, <i>Sun Life Assurance Society, 63 Threadneedle-street, E.C.</i>	1868	Spens, William George, <i>Scottish Amicable Life Assur. Soc., 35 St. Vincent-pl., Glasgow.</i>
1861**	Searle, Thomas John, <i>Mansion-house-chambers, Bucklersbury, E.C.</i>	1881	Stanciliffe, Frederick, <i>British Empire Mutual Life Assurance Company, 100 King-street, Manchester.</i>
1900**	Searls, Edwin Richard, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>	1860*	Stark, James, F.S.S., <i>Reversionary Interest Society, 30 Coleman-street, E.C.</i>
1899**a	Sharman, William Charles, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1866	Stark, William Emery, F.S.S., <i>Chapel-walks, Manchester.</i>
1900**	Sharpe, Edgar Cecil Engledne, <i>London Life Association, Ltd., 81 King William-street, E.C.</i>	1878	Stevenson, Charles, <i>9 Albert-square, Manchester.</i>
1894**a	Sheppard, Herbert Norman, B.A., <i>Union Central Life Office, Cincinnati, Ohio, U.S.A.</i>	1880	Stock, Edward James, <i>National Mutual Life Assoc. of Australasia, Melbourne, Australia.</i>
1899**	Sherriff, Francis Henry, <i>Provident Clerks' Mutual Life Assurance Association, 27 &amp; 29 Moorgate-street, E.C.</i>	1895**	Strong, William Richard, <i>London Guarantee &amp; Accident Co., 61 Moorgate-street, E.C.</i>
		1896**	Stuckey, Jos. James, M.A., <i>Salisbury Chambers, 49a King William-street, Adelaide, South Australia.</i>

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Date of becoming an Associate.		Date of becoming an Associate.	
1869	Surene, David John, F.F.A., 29 Inverleith-road, Edinburgh.	1884	Vincent, Frederick James, F.S.S., London, Edinburgh & Glasgow Assurance Co., Ltd., Insurance- buildings, Farringdon-street, E.C.
1899**	Symmons, Frank Percy, Prudential Assurance Company, Holborn-bars, E.C.	1899**	Vokins, George Alfred, Prudential Assurance Company, Holborn-bars, E.C.
1882	Tarn, Walter George, Reversionary Interest Society, 30 Coleman Street, E.C.	1883**	Walker, Davidson, F.F.A., Norwich Union Life Assurance Society, Norwich.
1893**	Taylor, Arthur, Westminster and General Life Assurance Assoc., 28 King-street, Covent-garden, W.C.	1879*	Wall, Walter George, Birkenhead.
1875	Taylor, J. Wilford, North British and Mercantile Insur. Co., 61 Threadneedle-st., E.C.	1878	Walton, William Gandy, F.F.A., Scottish Provident Institution. 6 St. Andrew-square, Edinburgh.
1895**a	Thodey, Robert, Australian Mutual Provident Society, Sydney, Australia.	1862*	Waterhouse, Edwin, M.A., F.C.A., F.S.S., 3 Frederick's-place, Old Jewry, E.C.
1898**	Thompson, Thomas Percy, B.A., British Empire Mutual Life Assurance Co., 4 & 5 King William-street, E.C.	1883**	Watson, John Robertson, British Law Fire Insurance Co., 176 West George-st., Glasgow.
1899**	Tinner, Thomas, Comptroller's Depart., London County Council, Spring-gardens, S.W.	1887	Watson, Reuben, Manchester Unity Friendly Soc., Nottingham.
1883**	Titmuss, Walter George, Provident Life Assurance Co., 50 Regent-street, W.	1894**	Watt, George, Royal Insurance Co., Liverpool.
1883*	Tregaskis, George Alfred, Hand-in-Hand Assurance Soc., 26 New Bridge-street, E.C.	1883*	Weall, Bertram, 16 Waldegrave-park, Twicken- ham.
1894**	Trenerry, Charles Farley, B.A., F.S.S., A Sul America Cia de Seguros de Fida, 971 Caixa do Correio, Rio de Janeiro.	1899**	Weatherill, Henry, National Debt Office, 19 Old Jewry, E.C.
1869**	Trew, Edward Bellingham, Law Life Assurance Society, 187 Fleet-street, E.C.	1894	Weeks, Rufus Wells, Mem. Act. Soc. Amer., New York Life Insurance Co., 346 & 348 Broadway, New York.
1891**	Turnbull, A. D. Lindsay, C.A., F.F.A., Commercial Union Assurance Co., 24, 25 & 26 Cornhill, E.C.	1898**a	Whigham, Charles Frederick, F.F.A., Messrs. Moncrieff & Horsburgh, 46 Castle-street, Edinburgh.
1877**	Turpin, William Gibbs, National Debt Office, 19 Old Jewry, E.C.	1884	Whyte, Alexander, London Assurance Corporation, 40 Pall Mall, S.W.
1884	Vian, William Collett, Railway Passengers' Assurance Company, 64 Cornhill, E.C.	1897**	Wickens, Charles H., Registrar-General's Office, Perth, W. Australia.

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Date of becoming an Associate.		Date of becoming an Associate.	
1896**	Wilkinson, Edward Berkeley, 12 Highclere-road, N. Kensington, W.	1875	Woods, Edward, <i>Victoria Life and General Insurance Co., Market-street, Collins-street-west, Melbourne, Australia.</i>
1900**	Wilson, George, <i>Standard Life Assurance Company, Edinburgh.</i>	1897**	Woolfe, Archibald William, B.A., 42 Church-crescent, Muswell-hill, N.
1870**	Wilson, Henry Edward, <i>Northern Ass. Co., 1 Moorgate-street, E.C.</i>	1898**	Woolmer, Alfred Henry, <i>Star Life Assurance Society, 32 Moorgate-street, E.C.</i>
1873**	Windett, Charles, <i>Legal &amp; General Life Assurance Soc., 10 Fleet-street, E.C.</i>	1898**	Workman, William Arthur, <i>Imperial Life Office, 1 Old Broad-street, E.C.</i>
1898**	Wood, Arthur Barton, B.A., Asso. Act. Soc. Amer., <i>Sun Life Assurance Co. of Canada, Montreal, Canada.</i>	1879*	Worrum, Thornton Selden, <i>Rock Life Assurance Company, 15 New Bridge-street, E.C.</i>
1883	Woodhouse, Lister, A.C.A., <i>Borough Treasurer, Town-hall, Birkenhead.</i>	1893**	Wright, Robert Young Murray, M.A., <i>Royal Insurance Co., Charing-cross, Birkenhead.</i>
1877**	Woods, Arthur Biddle, <i>Rock Life Assurance Company, 15 New Bridge-street, E.C.</i>	1871	Yardley, John, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1866	Woods, Bernard, <i>Metropolitan Life Assurance Soc., 13 Moorgate-street, E.C.</i>	1873	Young, Alexander Hunter, 60 Market-street, Melbourne, Australia.
		1900**	Young, Arthur Stanley, <i>Commercial Union Assurance Co., 24, 25 &amp; 26 Cornhill, E.C.</i>

## STUDENTS.

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Date of becoming a Student.		Date of becoming a Student.	
1892*	Aaron, David Hyam, <i>Sun Life Assurance Society, 63 Threadneedle-street, E.C.</i>	1900*	Bell, Henry Soady, <i>"Netherhall," The Drive, Sidcup, Kent.</i>
1891*	Anderson, Adam Thomson, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1897*	Benjamin, Stanley O., <i>Australian Mutual Provident Society, Melbourne.</i>
1886	Arnold, Thomas, Jun., <i>British Equitable Life Assurance Company, Queen-street-place, E.C.</i>	1898*	Bennell, Samuel Thomas, <i>20 Narford-road, Brooke-road, Clapton, S.E.</i>
1896*	Ashley, Charles Henry, <i>Refuge Assurance Company, Oxford-street, Manchester.</i>	1898*	Bennett, Samuel, <i>6 Gray-street, Workington.</i>
1897*	Ashton, William Richard, <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>	1895*	Bigby, Robert Frederick Mitchell, <i>General Assurance Company, 103 Cannon-street, E.C.</i>
1899*	Baber, Walter Crosbie, <i>Sun Life Assurance Co. of Canada, Montreal</i>	1900*	Bingeman, Milton H., <i>The Great West Life Assurance Company, Winnipeg, Manitoba, Canada.</i>
1897*	Backett, William Albert, <i>c/o Employers' Liability Assur. Corporation, Hamilton-house, Victoria Embankment, E.C.</i>	1891*	Bird, Edward William, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1898**	Bacon, James, <i>7 Charles-street, Crisp-street, Poplar, E.</i>	1898	Bishop, Harold Garfield, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1896**	Ball, Sidney Robertson, <i>English and Scottish Law Life Assurance Association, 12 Waterloo-place, S.W.</i>	1895*	Blake, Frederick Edward, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1897	Barfield, Edmund John, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1898*	Blake, Henry Prince, <i>Union Insurance Society, 81 Cornhill, E.C.</i>
1899*	Barnett, Isaac, <i>Universal Life Assurance Soc., 1 King William-street, E.C.</i>	1898*	Blake, Robert Walter Austin, <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>
1899*	Barrett, William Goodsman, <i>34 Penge-road, South Norwood, S.E.</i>	1895	Blanch, Frederick William, <i>Mutual Life Insurance Company of New York, 16, 17 &amp; 18 Cornhill, E.C.</i>
1896*	Barry, David, <i>Office of the Actuary for Friendly Societies, Melbourne, Australia.</i>	1887	Blossom, James, <i>186 South-view-road, Sheffield.</i>
1900*	Baxter, Edwin Herbert, <i>Scottish Provident Institution, 17 King William-street, E.C.</i>	1892*	Boddy, Henry Mitchell, <i>Imperial Life Assurance Co. of Canada, 58 Sparks-street, Ottawa, Canada.</i>



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Date of becoming a Student.		Date of becoming a Student.	
1897	Bond, Frederic D., 413 South 44th Street, Philadelphia, U.S.A.	1899*	Cherry, Christopher F., Citizens' Life Assurance Co., Sydney, Australia.
1900*	Borrajó, Edward Joseph William, Prudential Assurance Company, Holborn-bars, E.C.	1894	Child, Frank Edward, Fern Bank, Aston Fields, Broms- grove, Birmingham.
1897*	Bowles, Francis Marsh, Pearl Life Assurance Company, London Bridge, E.C.	1893	Chisholm, Daniel Henry, J.P., 7 Arundel-terrace, Forest-lodge, Sydney, Australia.
1891*	Boyd, Henry Norris, City of Glasgow Life Assurance Co., 21 St. Andrew-square, Edinburgh.	1891*	Claridge, William, M.A., London and Midland Bank- chambers, Bradford.
1899*	Brady, John Francis, Citizens' Life Assurance Co., Sydney, Australia.	1897	Clark, Beauchamp, Northern Assurance Company, 1 Moorgate-street, E.C.
1897	Brierley, William Ernest, Refuge Assurance Company, Oxford-street, Manchester.	1897*	Clinton, George, Prudential Assurance Company, Holborn-bars, E.C.
1893*	Briggs, Frederick William, Caxton-villa, Wood-green, X.	1895	Cogar, William Edward, New York Life Insurance Co., Trafalgar-square, W.C.
1894*	Brough, Frank, Federal Life Assurance Company, Hamilton, Ontario.	1898*	Collier, Charles Aubrey, 46 Crockerton-road, Tooting, S.W.
1891*	Brown, William Heron, Gresham Life Assur. Soc., Ltd., St. Mildred's-house, Poultry, E.C.	1895**	Collins, Frank Lakeman, Clerical, Medical & General Life Assurance Soc., 15 St. James's- square, S.W.
1889	Buckle, Frederick, 68 Belleville-road, Wandsworth- common, S.W.	1899*	Collins, Patrick A., Citizens' Life Assurance Co., Sydney, Australia.
1899*	Buckler, William Peach, B.A., 2 Collingham - gardens, South Kensington, W.	1891	Colvin-Smith, Colvin Arthur Edward, North British and Mercantile Insurance Co., 61 Threadneedle- street, E.C.
1898	Campbell, Walter M., North American Life Assur. Company, North American Life Building, 112-118 King-street- west, Toronto, Canada.	1892	Connolly, Edward, Australian Mutual Provident Society, Sydney, Australia.
1896	Carr, Stanley T., Australian Mutnal Provident Society, Sydney, Australia.	1896*	Cook, Henry Milton, Standard Life Assurance Co., Dalhousie-square, Calcutta, India.
1899*	Carter, Norman John, Eagle Insurance Company, 79 Pall-mall, S.W.	1900*	Cooper, Bernard Hugh, Prudential Assurance Company, Holborn-bars, E.C.
1900*	Chambers, John Joseph, 1 Church-street, Southport.		

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Date of becoming a Student.		Date of becoming a Student.	
1899*	Cotterill, William Ernest, <i>Mutual Life Assoc. of Australasia, Ltd., Sydney, Australia.</i>	1900*	Davies, William Allison, <i>13 Ash Leigh, Anfield, Liverpool.</i>
1897*	Court, Alexander George Dacus, <i>4 Langdale-road, Greenwich, S.E.</i>	1899*	Davison, Horace Williams, <i>Manufacturers' Life Insurance Co., Toronto, Canada.</i>
1896	Cox, Charles, <i>c/o Messrs. Marshall, MacEwan &amp; Co., 35 Queen Victoria-st. E.C.</i>	1891*	Dawson, Frank Aubrey, <i>Ecclesiastical Insurance Office, Ltd., 11 Norfolk-st., Strand, W.C.</i>
1894	Cox, Edward William, <i>Canada Life Assurance Co., Toronto, Canada.</i>	1899*	De Lury, George, <i>Imperial Life Assurance Co. of Canada, Toronto, Canada.</i>
1894	Cox, Herbert Coplin, <i>Canada Life Assurance Co., Toronto, Canada.</i>	1896*	de Ville, Francis, <i>Clergy Pensions Institution, 11 Norfolk-street, Strand, W.C.</i>
1896	Critchley, George Francis, <i>18 Handen-road, Lee, S.E.</i>	1896**	Diamond, George Frederick, <i>Australian Mutual Provident Society, Sydney, Australia.</i>
1887*	Cross, Henry John, <i>3 Park-rd., Wandsworth-common, S.W.</i>	1897*	Dick, William Thos., B.A., M.L.A., <i>Newcastle, N.S.W.</i>
1897*	Cross, Howard Turner, <i>Economic Life Assurance Soc., 6 New Bridge-street, E.C.</i>	1895*	Dickinson, Frank Ridley, <i>Peterborough-house, Harrow-on-the-Hill.</i>
1897*	Crump, Percy C., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1890*	Docker, Leslie, <i>North British and Mercantile Insurance Co., 61 Threadneedle-street, E.C.</i>
1897*	Culley, Alfred Benjamin, <i>Star Life Assurance Society, 32 Moorgate-street, E.C.</i>	1897*	Dorrian, John Christopher, <i>Citizens' Life Assurance Company, Sydney, Australia.</i>
1897**	Curjel, H. W., M.A., <i>Royal Insurance Co., Liverpool.</i>	1899*	Douglas, J. Joseph, <i>Irish Land Commission, 24 Upper Merrion-street, Dublin.</i>
1897*	Dalton, John, <i>London Life Association Ltd., 81 King William-street, E.C.</i>	1893*	Doust-Smith, Ernest Charles, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1891	Daniell, Ferrers Aitken, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>	1900*	Doust, William Frederick, <i>National Debt Office, 19 Old Jewry, E.C.</i>
1896	Daughtrey, William Lamb, Jun., <i>Life Insurance Co. of Virginia, Richmond, Virginia, U.S.A.</i>	1897**	Dunn, Spencer Græme, <i>University Life Assurance Soc., 25 Pall Mall, S.W.</i>
1896*	Davey, Clarence, <i>Pearl Life Assurance Company, London-bridge, E.C.</i>	1897*	Dunn, Walter James, <i>Citizens' Life Assurance Company, Sydney, Australia.</i>
1889*	Davies, Hugh Myddelton, <i>Royal Insurance Co., Liverpool.</i>		

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Date of becoming a Student.		Date of becoming a Student.	
1899**	Earle, Arthur Percival, <i>North American Life Assur. Co., North American Life Building, 112-118 King-st. West, Toronto, Canada.</i>	1886	Garcke, Emile, F.S.S., M.I.E.E., <i>Sunnyside, Bedford-park, w.</i>
1897*	Ecroyd, Cutlbert W., <i>Friends' Provident Institution, Bradford.</i>	1900*	Garner, James, <i>9 Arlington Park-gardens North, Chiswick, w.</i>
1891	Edlmann, Herbert Elliot, <i>Royal Exchange Assurance Cor- poration, Royal Exchange, E.C.</i>	1898***	Gibson, J. Paul S. R., <i>Pelican Life Insurance Co., 70 Lombard-street, E.C.</i>
1892	Edwards, Edward Samuel, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1899*	Giles, Hylton Lloyd, <i>British Empire Mutual Life Assurance Co., 4 &amp; 5 King William-street, E.C.</i>
1892*	Eedy, Arthur Malcolm, <i>Citizens' Life Assurance Com- pany, Sydney, Australia.</i>	1895*	Gill, James Stewart, <i>Australian Widows' Fund Life Assurance Society, Melbourne, Australia.</i>
1900*	Elderton, Robert Lapidge, <i>National Provident Institution, 48 Gracechurch-street, E.C.</i>	1900*	Gillespie, Joseph Hugh Ross, <i>Manufacturers' Life Insurance Company, Toronto, Canada.</i>
1893*	Emery, John M., <i>American Union Life Insurance Co., Bowling Green-building, Broadway, New York.</i>	1893	Glasson, George Cornish, <i>Economic Life Assurance Soc., 4 St. Stephen's-chbrs., Baldwin- street, Bristol.</i>
1892*	Farrell, John, <i>Citizens' Life Assur. Co., 210 Queen-st., Brisbane, Australia.</i>	1893*	Gledstone, W. L., <i>Royal Exchange Assur. Corpora- tion, Royal Exchange, E.C.</i>
1886	Fells, John Manyer, F.S.S., <i>85 Gracechurch-street, E.C.</i>	1897*	Goddard, Egbert, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1887	Fisher, Hugh Strettell, <i>1 Avoca-terrace, Blackrock, co. Dublin.</i>	1894*	Golding, Arthur, <i>41 Digby-rd., Finsbury-park, n.</i>
1892	Fisher, Walter Churchill, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1888*	Gooding, Harold John, <i>Law Guarantee and Trust Soc., Ltd., 56 Moorgate-street, E.C.</i>
1896*	Fisk, George William Victor, F.S.S., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1900*	Goodman, Gilbert, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1898*	FitzGerald, William George, <i>London &amp; Lancashire Life Assurance Co., 164 St. James'-st., Montreal.</i>	1892	Gordon, Alexander, <i>168 Islington, Liverpool.</i>
1890	Gamman, Robert Ebenezer, <i>London Joint Stock Bank, Princes-street, E.C.</i>	1896*	Gordon, Harry Duncan Lockhart, <i>221 George-st., Toronto, Canada.</i>
		1897**	Gosset, Thorold, <i>21 Old-bldgs., Lincoln's-inn, w.c.</i>
		1886	Gover, Frederick Field, F.S.S., <i>10 Lee-park, Blackheath, s.e.</i>

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Date of becoming a Student.		Date of becoming a Student.	
1895*	Grant, Kenneth Stuart, <i>Alliance Assurance Company, 1 Bartholomew-lane, E.C.</i>	1896*	Harrison, Tom Marriott, <i>Life Association of Scotland, 5 Lombard-street, E.C.</i>
1899*	Gray, Robert Alexander, B.A., <i>Northern Life Assurance Co., London, Ontario, Canada.</i>	1897*	Harriss, Walter James, <i>Life Association of Scotland, 5 Lombard-street, E.C.</i>
1900*	Green, James Proctor, <i>Refuge Assurance Co., Oxford-street, Manchester.</i>	1896	Haskins, George Frederick, A.C.A., <i>7 Elmfield-road, Balham, S.W.</i>
1886	Greening, Herbert Joseph, <i>Abolitionists &amp; General Insur. Co., City-buildings, Birmingham.</i>	1894*	Hatten, David Leslie, <i>Standard Life Assurance Co., 3 George-street, Edinburgh.</i>
1887	Griffin, William, <i>18 Patrick-street, Cork.</i>	1897*	Hay, John Dalziel, <i>Crown Lands Office, Wellington, New Zealand.</i>
1899*	Grigg, Benjamin, <i>Sun Life Assur. Co. of Canada, Montreal, Canada.</i>	1892	Hellyer, Arthur Lee, <i>Shannon-court, Bristol.</i>
1899*	Guest, Smith Austin, <i>Pen-y-Bryn, Bangor, North Wales.</i>	1897*	Hepburn, Charles James, <i>1 Elgin-road, Croydon.</i>
1900*	Hall, John Bertram, <i>Imperial Life Assurance Co. of Canada, Toronto, Canada.</i>	1898	Heyner, Herbert Augustus Otto, <i>Union Insurance Society, 81 Cornhill, E.C.</i>
1896*	Hallman, M. S., <i>The Mutual Life Assurance Co. of Canada, Waterloo, Ontario.</i>	1891	Higinbotham, Harry Newburgh, <i>Royal Exchange Assur. Corpora- tion, Royal Exchange, E.C.</i>
1899*	Halloran, George Henry, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1896**	Hines, Walter Robert, <i>Norwich Union Life Office, Norwich.</i>
1900*	Hammond, Reginald, <i>Scottish Widows' Fund, 21 Park- row, Leeds.</i>	1897	Hitchins, William Richmond, B.A., <i>Manufacturers' Life Insurance Company, Toronto.</i>
1892	Hancock, Arthur Tom, <i>Clerical, Medical &amp; General Life Assurance Society, 15 St. James's- square, S.W.</i>	1900*	Hobbins, Charles Barton, <i>National Debt Office, 19 Old Jewry, E.C.</i>
1895*	Harding-Newman, Thomas Harold, <i>Scottish Amicable Life Assur. Soc., 1 Threadneedle-street, E.C.</i>	1896*	Hogg, Charles, <i>10 Whitehall-place, S.W.</i>
1895*	Harper, Sidney, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1894	Holdsworth, David Arundell, <i>Star Life Assur. Soc., 22 Eldon- square, Newcastle-on-Tyne.</i>
1889*	Harris, Henry, <i>Friends' Provident Institution, Bradford.</i>	1898*	Hooper, George Duncan, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>

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Date of becoming a Student.		Date of becoming a Student.	
1894*	Hopping, Donald McKay, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>	1896*	Jepps, John Blacklee, <i>English and Scottish Law Life</i> <i>Assurance Assoc., 12 Waterloo-</i> <i>place, S.W.</i>
1895**	Horn, Ernest Frederick, <i>The Boltons, Sidcup, Kent.</i>	1898*	Johnston, Arthur Edward, <i>3 Cumnor-road, Sutton.</i>
1889*	Hudson, Frederick Charles, <i>Lancashire Insurance Company,</i> <i>18 Exchange-street, Manchester.</i>	1898	Johnston, James O., <i>Law Union &amp; Crown Insur. Co.,</i> <i>126 Chancery-lane, W.C.</i>
1898	Hughes, Arthur J., <i>The Insurance Agency Cor-</i> <i>poration, Toronto, Canada.</i>	1899*	Jones, Leonard Alexander Mouat, <i>Hand-in-Hand Insur. Society,</i> <i>26 New Bridge-street, E.C.</i>
1900*	Hughes, Arthur Sidney, <i>6 Telford-avenue, Streatham-</i> <i>hill, S.W.</i>	1896*	Jones, Richard Foxley, <i>Refuge Assurance Co., Oxford-</i> <i>street, Manchester.</i>
1897*	Humphrey, Bernard, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>	1896*	Jones, Wallace Mouat, <i>General Reversionary &amp; Invest-</i> <i>ment Company, Limited, 26 Pall-</i> <i>mall, S.W.</i>
1891	Hunt, Arthur Leonard, <i>Wesleyan and General Assur.</i> <i>Society, 18 New Bridge-st., E.C.</i>	1894*	Jupp, Henry Lewis, <i>Guardian Assurance Company,</i> <i>11 Lombard-street, E.C.</i>
1899*	Hunter, Robertson G., <i>New York Life Insur. Co., 346</i> <i>&amp; 348 Broadway, New York.</i>	1893**	Kelham, Cyril Stephen, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>
1893	Hutchins, Alexander Constantine, <i>11 Pancras-lane, Queen-st., E.C.</i>	1896**	Kenehington, Charles William, <i>Prudential Assurance Company,</i> <i>Holborn-bars, E.C.</i>
1899*	Jackaman, Arthur Fredk. Samuel, <i>39 Brunswick-bldgs., Goulston-</i> <i>street, Aldgate, E.</i>	1900*	Kennedy, Edward Robert, <i>National Debt Office, 19 Old</i> <i>Jewry, E.C.</i>
1888*	Jackson, Edward Ellis, <i>Equity &amp; Law Life Assur. Soc.,</i> <i>18 Lincoln's-inn-fields, W.C.</i>	1898	Kidson, Leonard Douglas, <i>15 Roe-lane, Southport.</i>
1890**	Jackson, Samuel, <i>Scottish Widows' Fund Life</i> <i>Assurance Society, Liverpool.</i>	1896*	Kimber, Richard John, <i>Royal Insurance Co., Buenos</i> <i>Ayres.</i>
1900*	Jarman, William Rees, B.A., <i>National Debt Office, 19 Old</i> <i>Jewry, E.C.</i>	1894**	Kingsbury, James William, <i>Australian Mutual Provident</i> <i>Society, Sydney, Australia.</i>
1895*	Jenkyn, John, <i>Ocean Accident &amp; Guarantee</i> <i>Corp., 40-44 Moorgate-st., E.C.</i>	1899	Kirby, Sydney Frederick, M.A., <i>Rowsley, Middle-lane, Hornsey, N.</i>
1897	Jennings, Alfred Wilson, <i>The Crossways, Shrewsbury-rd.,</i> <i>Harlesden, N.W.</i>	1900*	Kirkham, Alfred, <i>229 Chapel-street, Prahran,</i> <i>Victoria, Australia.</i>



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Date of becoming a Student.		Date of becoming a Student.	
1899*	Kissau, Edgar Duguid, <i>Atlas Assurance Company, 92 Cheapside, E.C.</i>	1899	Mackenzie, Michael Alexander <i>Trinity College, Toronto, Canada.</i>
1895*	Knight, Alfred Murray, <i>Bank-ho., Chapel-st., Devonport.</i>	1898	Mackenzie, William Alexander, <i>North American Life Assur. Co., North American Life Building, 112-118 King-st.-west, Toronto, Canada.</i>
1897	Krause, Holger Erasme, <i>Prudential Insurance Company of America, Newark, N.J., U.S.A.</i>	1896	Marlow, Thomas Gibbons, A.I.S., <i>13 St. Ronan's-road, Abbeydale, Sheffield.</i>
1895	Laing, Oswald George, <i>North British and Mercantile Insurance Co., Park-row, Leeds.</i>	1896*	Marshall, Gerald, <i>Imperial Life Insurance Co., 22 Pall-mall, S.W.</i>
1890*	Lawson, Henry Graham Stuart, <i>Scottish Accident Insur. Co., Ltd., 115 George-street, Edinburgh.</i>	1893*	Martin, William Anderson, M.A., <i>Scottish Provident Institution, Dublin.</i>
1891	Layzell, Phillip Cuddington, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1900*	May, Walter Thomas, <i>Scottish Amicable Life Assurance Society, 1 Threadneedle-st., E.C.</i>
1893	Le Maistre, Charles H., <i>Penn Mutual Life Insurance Co., Philadelphia, U.S.A.</i>	1895*	Mayhew, Percy Craske, <i>Westminster and General Life Assurance Assoc., 28 King-st., Covent-garden, W.C.</i>
1892	Le Maistre, George Harry, <i>Assistant Accountant-General, Public Works Department, Supreme Government, India.</i>	1888*	McConway, James Robert, <i>Royal Insurance Company, Liverpool.</i>
1894	Leonard, Maurice, <i>14 Sotheby-rd., Highbury, N.</i>	1895	McLeod, James Stirling, <i>c/o Messrs. Williams &amp; Keble, Ltd., Napier, New Zealand.</i>
1896*	Ley, James, <i>Office of the Actuary for Friendly Societies, Melbourne, Australia.</i>	1897*	McPhail, Frederick Charles, <i>Colonial Mutual Life Assurance Society, Limited, Melbourne, Australia.</i>
1889*	Lighton, Harold John, <i>Law Union &amp; Crown Insurance Co., 126 Chancery-lane, W.C.</i>	1890*	Meikle, Henry George Watson, <i>F.F.A., Oriental Life Assurance Co., Bombay.</i>
1895*	Littell, Lewis Lloyd, <i>Standard Life Assurance Co., 83 King William-street, E.C.</i>	1897*	Melville, Charles Edward, <i>Citizens' Life Assurance Co., Wellington, New Zealand.</i>
1890	Love, Robert, <i>Pelican Life Insurance Company, 70 Lombard-street, E.C.</i>	1892*	Meyers, Henry Wilson, <i>National Mutual Life Association of Australasia, Melbourne, Australia.</i>
1894	Lucey, Frederick Samuel, F.C.A., <i>15 George-st., Mansion-house, E.C.</i>		
1891	Lyon, Thomas Glover, M.D., <i>1 Victoria-square, S.W.</i>		

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Date of becoming a Student.		Date of becoming a Student.	
1896*	Milligan, Charles Livingstone, <i>Provident Life Office, 3 Cook-street, Liverpool.</i>	1895*	Newnham, Ernest Whiffin, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1894*	Mills, Thomas Percy, <i>Mutual Life Association of Australasia, Sydney, Australia.</i>	1897	Nicholls, Robert James, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>
1899**	Minns, Ernest Edwin, <i>Norwich Union Life Office, Norwich.</i>	1900*	Norsworthy, Edward C., <i>c/o Messrs. E. H. Gay &amp; Co., Canada Life Building, Montreal, Canada.</i>
1897	Mirams, Arthur Greyford, <i>Australian Temperance &amp; General Life Assurance Soc., Melbourne, Australia.</i>	1900*	Norsworthy, Stanley Counter, <i>Bank of Montreal, Halifax, Nova Scotia.</i>
1898*	Moore, George Cecil, <i>Imperial Life Insurance Co. of Canada, Toronto, Canada.</i>	1891	O'Neill, Harry Duncan, <i>Clerical, Medical &amp; General Life Assurance Society, 36 Park-row, Leeds.</i>
1900*	Moore, George Edward, <i>Australian Widows' Fund Life Assurance Company, Melbourne, Australia.</i>	1892*	O'Reilly, Anthony James, <i>Government Insurance Department, Ottawa, Canada.</i>
1895*	Moore, Gerald Leslie, A.C.A., <i>58 Coleman-street, E.C.</i>	1897*	Osborn, Nathaniel Banner Francis, <i>34 Lansdowne-road, Tottenham, N.</i>
1898*	Moore, Stanley, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1893*	Owen, Edgar Theodore, F.S.S., <i>Registrar of Friendly Societies, Perth, Western Australia.</i>
1895*	Morgan, George Frederick Hughes, <i>Law Guarantee &amp; Trust Society, 49 Chancery-lane, W.C.</i>	1893*	Papps, Percy Charles Herbert, <i>Canada Life Assurance Company, Toronto, Canada.</i>
1893*	Morland, Alfred, A.C.A., <i>30 Gracechurch-street, E.C.</i>	1891*	Parisot, Oscar, <i>71 Fleet-street, E.C.</i>
1896	Morrison, Hubert Peter, <i>2 Edmund-street, Birmingham.</i>	1895*	Pascoe, William Yeoman Bennett, <i>Prudential Assurance Company, Holborn-bars, W.C.</i>
1897	Mugford, Stanley, <i>New York Life Insurance Co., Trafalgar-square, W.C.</i>	1897	Paton, Harry Arthur, <i>Royal Exchange Assurance Corporation, Royal Exchange, E.C.</i>
1896*	Neale, Maurice Baldwin, <i>Alliance Assurance Company, 61 New-street, Birmingham.</i>	1892*	Pearce, Charles Edward, <i>3 Birchwood-villas, Clarence-road, Sidcup, Kent.</i>
1900*	Neill, Samuel Bennett, <i>17 Therapia-road, Honor Oak, S.E.</i>	1898	Peirson, Percy F., <i>17 Hertford-street, Coventry.</i>

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Date of becoming a Student.		Date of becoming a Student.	
1896*	Penman, William, <i>Northern Assurance Company,</i> 1 <i>Moorgate-street</i> , E.C.	1898	Robertson, Douglas Gordon, <i>Essex-lodge, Muswell-hill</i> , S.
1897	Pennington, Cyril Burn, 23 <i>Trebovir-road, Earl's-court</i> , S.W.	1896*	Robinson, Frederick Charles, <i>Royal Exchange Assur. Corpora-</i> <i>tion, Royal Exchange</i> , E.C.
1896**	Penny, Charles Augustus, <i>Prudential Assurance Company,</i> <i>Holborn-bars</i> , E.C.	1898*	Robinson, Hugh Thomas Kay, <i>Clergy Mutual Assurance Society,</i> 2 & 3 <i>The Sanctuary, Westminster</i> , S.W.
1898*	Pigrome, George Davey, <i>Prudential Assurance Company,</i> <i>Holborn-bars</i> , E.C.	1893*	Roll, Frederick James, <i>Pearl Life Assurance Company,</i> <i>London-bridge</i> , E.C.
1898	Poort, Willem Anthonie, Phil. Nat. Doct., <i>Middelberg, Holland</i> .	1893*	Roodenburch, Bartholomeus Adrianns, <i>Algemeene Maatschappij van</i> <i>Levensverzekering en Lijfrente,</i> <i>Damrak, 74, Amsterdam</i> .
1892*	Powell, Harold Charlesworth, <i>Equitable Life Assurance Soc.,</i> <i>Mansion-house-street</i> , E.C.	1895*	Ross, Christopher Watson, <i>G.P.O., Box 160, Melbourne,</i> <i>Australia</i> .
1893*	Pownall, Herbert Wilfred, <i>Australian Mutual Provident</i> <i>Society, Adelaide, Australia</i> .	1895	Rowley, James Edward, 7 <i>Waterloo-street, Birmingham</i> .
1898*	Pring, Arnold Lyddon, <i>Prudential Assurance Company,</i> <i>Holborn-bars</i> , E.C.	1895*	Rudd, Alfred James, <i>Australian Widows' Fund Life</i> <i>Assurance Society, Melbourne,</i> <i>Australia</i> .
1897	Proctor, Jr., William, <i>Refuge Assurance Company,</i> <i>Oxford-street, Manchester</i> .	1899*	Rutter, Edward Valentine, 129 <i>Tredegar-road, Bow</i> , E.
1886*	Quick, John Richard, <i>Equity &amp; Law Life Assur. Soc.,</i> 18 <i>Lincoln's-inn-fields</i> , W.C.	1894	Salter, George Ferry, Mem. Act. Soc. Amer., <i>Prudential Insurance Company</i> <i>of America, Newark, N.J., U.S.A.</i>
1898	Reynell, Guy Courtenay, <i>National Mutual Life Assurance</i> <i>Society, 39 King-st., Cheapside,</i> E.C.	1894*	Sanderson, Finlay, <i>North British and Mercantile</i> <i>Insurance Company, 61 Thread-</i> <i>needle-street</i> , E.C.
1898	Rhodes, Francis, <i>Lancashire Insurance Co., 18</i> <i>Exchange-street, Manchester</i> .	1894*	Saunders, Herbert Stewart, M.A., 3 <i>Bolton-gardens</i> , S.W.
1894*	Richards, Gilbert P. A., <i>Royston-rilla, New Barnet</i> .	1892*	Savery, Robert S. B., <i>Gresham Life Assurance Society,</i> <i>Giselastrasse, No. 1, Vienna</i> .
1894**	Rietschel, Hermann Julius, <i>Sun Life Assurance Society, 63</i> <i>Threadneedle-street</i> , E.C.	1897	Sawtell, John A., <i>Law Accident Insurance Society,</i> 215 <i>Strand</i> , W.C.

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Date of becoming a Student		Date of becoming a Student.	
1897*	Scott, Alexander Lewis, <i>Australian Mutual Provident Society, Melbourne.</i>	1894*	Smith, Lionel Gordon, <i>Wyecroft, Bexley.</i>
1900*	Searle, Arthur Joseph, <i>English &amp; Scottish Law Life Assurance Association, Limited, 12 Waterloo-place, S.W.</i>	1900*	Somerville, Walter Harold, <i>Mutual Life Insurance Company of Canada, Waterloo, Ontario, Canada.</i>
1888	Sewell, Richard, C.A., F.F.A., <i>63 Threadneedle-street, E.C.</i>	1897*	Stamp, Horatio E., <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1886*	Sharp, Joseph Benjamin, <i>Clerical, Medical and General Life Assurance Society, 15 St. James's-square, S.W.</i>	1898**	Stewart, Lionel William, <i>Alliance Assurance Company, Bartholomew-lane, E.C.</i>
1896	Shawyer, John William, <i>Law Union &amp; Crown Insurance Co., 126 Chancery-lane, W.C.</i>	1886**	Stirling, James, <i>Scottish Imperial Insurance Co., 183 West George-st., Glasgow.</i>
1900*	Shovelton, Sydney Taverner, <i>532 Eccles New-road, Manchester.</i>	1888*	Stott, Walter, <i>Royal Insurance Co., Liverpool.</i>
1896*	Shute, Oxenham Bent, <i>National Provincial Bank of England, 53 Baker-street, W.</i>	1893*	Streeter, Theodore Edward, <i>Hampden House, Phoenix-street, King's-cross, N.W.</i>
1895	Simmons, Lancelot, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>	1899*	Stuckey, Reginald Robert, <i>Australian Mutual Provident Society, Adelaide, S. Australia.</i>
1892*	Simpson, William Murray, <i>North British and Mercantile Insurance Company, 61 Threadneedle-street, E.C.</i>	1895*	Sutton, Cecil Norman Stafford, <i>Marine &amp; General Mutual Life Assurance Society, 14 Leadenhall-street, E.C.</i>
1891*	Sindall, Alfred John, <i>London and Lancashire Life Assurance Co., 66 &amp; 67 Cornhill, E.C.</i>	1892*	Tappenden, Laurence Barnard, <i>Strathmore, 15 Burlington-gdns., Chiswick, W.</i>
1899*	Skelton, Reginald Albert, <i>c/o Messrs. H. J. Skelton &amp; Co., 12 Lime-street, E.C.</i>	1889*	Taylor, John Theodore, <i>Templemore-park, Londonderry.</i>
1888**	Slimon, William James, F.F.A., <i>2 James'-place, Leith.</i>	1895	Taylor, Leopold Victor, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
1895*	Smeaton, John Richard, <i>Alliance Assurance Company, 61 New-street, Birmingham.</i>	1895*	Thistlethwaite, William, <i>4 Warren-terrace, Wakefield.</i>
		1900*	Thomson, Frederick Robert T., <i>11 Baalbeck-road, Highbury, N.</i>

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Date of becoming a Student.		Date of becoming a Student.	
1897*	Thorne, Charles McKellar, <i>Temperance &amp; General Life Assur. Co., cr. Swanston &amp; Little, Collins-st., Melbourne, Australia.</i>	1898*	Webb, Lloyd, <i>Hand-in-Hand Insurance Soc., 26 New Bridge-street, E.C.</i>
1897*	Touzel, Philip Duncan, <i>Australian Mutual Provident Society, Melbourne, Australia.</i>	1893*	Welman, Arthur Joseph, <i>Legal &amp; General Life Assurance Society, 10 Fleet-street, E.C.</i>
1897*	Townshend, Edward Villiers, <i>North British and Mercantile Insurance Co., 7 Tithebarn-street, Liverpool.</i>	1888	Westland, James Black, <i>Northern Assurance Company, 1 Moorgate-street, E.C.</i>
1897	Truzzell, Harry, <i>Northern Assurance Company, 15 Victoria-street, Nottingham.</i>	1896*	Wheatley, George Frederick Layfield, <i>Liverpool and London and Globe Insurance Company, 7 Cornhill, E.C.</i>
1891	Tyler, Edgar Alfred, F.S.S., <i>20 Bucklersbury, E.C.</i>	1897*	Wigner, John Gurney, <i>92 Tyrwhitt-road, St. John's, S.E.</i>
1893	Vine, George Henry Mesban, <i>23 Grange-road, Canonbury, N.</i>	1886*	Williams, David, <i>181 Queen Victoria-street, E.C.</i>
1895*	Walker, David Edgar, <i>Australian Mutual Provident Society, Sydney, Australia.</i>	1894*	Williams, Frederick Alfred, <i>102 Geldeston-road, Upper Clapton, N.E.</i>
1896	Walter, Frederic Percy, A.C.A., <i>11 Ironmonger-lane, E.C.</i>	1895*	Williams, Henry Samuel Walter, <i>The Imperial Insur. Co., Ltd., 410 Collins-street, Melbourne, Australia.</i>
1900*	Wandless, John Robert, <i>1 Cromwell-place, Hockley, Essex.</i>	1899*	Williams, William, B.A., <i>Orlando Aren., Mosman, Sydney, N.S.W., Australia.</i>
1898	Ward, Albert E., <i>Australian Mutual Provident Society, Melbourne, Australia.</i>	1900*	Wilkinson, William Magnay, Jun., <i>Citizens' Life Assurance Co., Sydney, Australia.</i>
1900*	Wares, Harold Wallace, <i>Yorkshire Insurance Company, 2, Bank-buildings, Princes-street, E.C.</i>	1896**	Wilson, John Sydney, <i>Australian Widows' Fund Life Assurance Society, Melbourne, Australia.</i>
1891	Waters, Charles Preston, <i>Equitable Life Assur. Society, Mansion-house-street, E.C.</i>	1894*	Windett, Sydney V., <i>Eagle Insurance Company, 79 Pall-mall, S.W.</i>
1900*	Watt, Arthur W., <i>169 Mansfield-street, Montreal, Canada.</i>	1888*	Wingfield, Harry, M.A., F.C.A., <i>64 Cannon-street, E.C.</i>
1896	Way, Claude Frederic, <i>Scottish Widows' Fund Life Assurance Society, 28 Cornhill, E.C.</i>	1899*	Winstanley, Charles William, <i>North British &amp; Mercantile Insurance Co., 8 Waterloo-place, S.W.</i>
1899*	Weatherill, Charles, <i>The Scottish Office, Whitehall, S.W.</i>		



## STUDENTS.

Those marked \* have passed the first of the three parts of the Examination for the Class of Fellow. Those marked \*\* have passed two of the three parts of the Examination for the Class of Fellow; those marked \*\*a, or \*\*b, have also passed either Section A or Section B of Part III of the Examination.

Date of becoming a Student.		Date of becoming a Student.	
1895*	Wood, David James, <i>Commercial Union Assurance Co., 24, 25 &amp; 26 Cornhill, E.C.</i>	1888**a	Worthington, William, <i>Lancashire Insurance Company, 18 Exchange-street, Manchester.</i>
1900*	Wood, William Archibald Porter, <i>Canada Life Assurance Co., Toronto, Canada.</i>	1894*	Wyatt, George Matthew, <i>Law Guarantee &amp; Trust Society, 49 Chancery-lane, W.C.</i>
1896*	Woodhouse, Hubert Allen, <i>Union Insurance Society, 81 Cornhill, E.C.</i>	1894*	Wylie, Samuel Brown, A.M., <i>112 N. Broad-st., Philadelphia, U.S.A.</i>
1900*	Woolston, Paul Livingston, <i>New York Life Insurance Co., 346 &amp; 348 Broadway, New York.</i>	1886	Yeatman, Alexander Alfred, <i>2 Gresham-buildings, E.C.</i>
1900*	Worth, Bertram Oliver, <i>Clerical, Medical &amp; General Life Assurance Society, 15 St. James's-square, S.W.</i>	1895*	Yeldham, William James, <i>Prudential Assurance Company, Holborn-bars, E.C.</i>
		1897*	Younger, R. Hugh, <i>Lancashire Insurance Co., 18 Exchange-street, Manchester.</i>

\*\* It is requested that any inaccuracy in the foregoing list may be pointed out to the ASSISTANT SECRETARY.

## CORRESPONDING MEMBERS.

## Belgium.

## BRUSSELS.

M. Henri F. G. Adan,  
*Directeur Général de la Royale Belge  
Compagnie Anonyme d'Assurances à  
Forfait sur la Vie, et contre les  
accidents, Rue Royale (coin impasse  
du Parc), Membre de la Commission  
Centrale de Statistique du Royaume  
de Belgique.*

M. AM. Bégault, Mem. Act. Soc. Amer.,  
*Hon. Secretary of the Association  
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M. Léon Hanoir,  
*Directeur Général de la Cie. des Pro-  
priétaires Réunis, 16 Rue de Loxum.*

M. Fl. Hankar,  
*First Director of the Caisse Générale  
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d'Haecht.*

M. Omer Lepreux, Mem. Act. Soc. Amer.,  
*Directeur - Général de la Caisse  
Générale d'Epargne et de Retraite de  
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manent des Congrès Internationaux  
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ciation des Actuaire Belges. Membre  
Correspondant de l'Institut des Actuaire  
Français. Membre de la Com-  
mission Permanente des Sociétés  
Mutualistes. Ancien Capitaine du  
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## PARIS.

M. Edouard Antoine Badon-Pascal,  
*Directeur du Journal des Assurances,  
22 Rue Le Peletier.*

## PARIS.—Continued.

M. Léon Marie, Mem. Act. Soc., Amer.,  
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d'Assurances sur la vie; Membre  
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M. Paul Guieysse, Mem. Act. Soc., Amer.,  
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## United States.

## NEW YORK.

Mr. David Parks Fackler,  
*Ex-President of the Actuarial Society  
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Actuary, 35 Nassau-street.*

# RULES

FOR THE

## REGULATION OF THE LIBRARY.

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1. The Library is open daily, from Ten to Five, from 1st of May to 30th September, and from Ten to Six from 1st of October to 30th April, except on Saturdays, when it is open from Ten to Two. It is closed for revision during the month of September.

2. Members of the Institute are permitted to take out Two Books on making application in person, or by letter addressed to the Assistant Secretary; but no Member may keep any work longer than a Fortnight. If a Book be retained beyond that period, the borrower shall pay a fine of One Shilling per volume for each week, or part of a week, during which it is so retained, and shall not be permitted to obtain another from the Library until the missing book has been returned and the fine paid. When a Book is returned by a Member, it can be borrowed by him again, provided it has not been bespoken in the meantime by another Member.

3. Scientific Journals and Periodicals are not circulated until the volumes are completed and bound.

4. Cyclopædias and works of reference and certain other volumes are not circulated.

5. Any Member damaging, or losing, a work must pay an amount to be fixed by the Council as the equivalent of the damage or loss sustained.

6. Works taken from the shelves for reference are not to be replaced, but must be laid on the Library table.

7. A list of defaulters shall be submitted monthly at each meeting of the Council.

By Order of the Council.

*November, 1899.*

# JOURNAL

## OF THE

### INSTITUTE OF ACTUARIES.

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#### *Events and Wants:*

*A Presidential Address, by* CHARLES DANIEL HIGHAM, Esq.

[Delivered 26 November 1900.]

THE first words of the address of a newly-elected President can hardly fail to be of gratitude for the kindly feeling which has exalted to the head of a loved profession one who claims but to be a student all his days; and I can offer no return for the magnificent compliment but an earnest service of the Institute, my *alma mater*, and an entire intention to do all that may be done for its well-being, and that of every member thereof. As I look back on the giants who have preceded me, or forward and speculate on the future attainments of those who are now winning their golden spurs, it is not this place that I would wish to occupy, but I trust to the cordial support of colleagues and friends which is traditional among us, and go on with a willing mind to meet all that is to be during my period of office.

And at once, with the dignity, the skeleton appears in the concurrent duty of making some few remarks on this occasion, as the authorized method of beginning this series of our meetings, in spite of the difficulty of finding time for their preparation amid the pressure of many claims. Nor is it easy to discover a subject for a deliverance of this nature, for it has, perhaps, a rather more general circulation than the papers that are

regularly put before us, so that, while it should have a close relation to our pursuits, it ought not to be too technical; it must be definite without being over controversial so far as we ourselves are concerned; and it should also, "if it be possible", have an element of freshness, as it avoids many outworn themes on which the future may yet bring something to say. I have thought, therefore, that we might briefly notice some of the events, connected with our occupations, which have occurred since he whom I unworthily follow spoke to us a year ago; and go on to consider certain wants of our profession which will, I hope, command our general agreement, in the hope that, should these words be cast over the more extended area, they may perchance bring us some assistance in those matters which are beyond our attainment unaided. I can hardly hope for a novelty, or even to escape all repetition of what has been better said before, but I have endeavoured to avoid plagiarism by putting these observations together without studying the utterances already in our *Journal*, and I would add that on myself alone must rest the responsibility for any views I may express.

Doubtless the principal event of the year for our profession has been the Third International Congress of Actuaries, held with much success in Paris in June; and those of us who were able to attend it have the happiest recollections of the courtesy and consideration of our brethren, as well as of M. Millerand, the Minister of Commerce, and his officials, and of all with whom we came into contact. And not only did M. Paul Guieysse, the President of the Institut des Actuaire Français and of the Congress itself, M. Omer Lepreux, Vice-President of the Association des Actuaire Belges and President of the Comité Permanent des Congrès Internationaux d'Actuaire, and M. Léon Marie, General Secretary of the Institut des Actuaire Français and of the Congress, seem to go out of their way to make much of the English, but it was especially gratifying that, at a time when we had heard of ill-treatment of our compatriots abroad, there was added to the hearty welcome of our friends and the graceful attentions of the Government, the invariable politeness of the people at large, of whom we saw something when not scientifically employed. In groups and alone we wandered among them, and in the streets and in the cafés, in the gardens and the crowds, we were everywhere and always shown the kindly civility of other days. Certain newspapers may have had at that time no more respect for



Her Majesty than for the rulers of France, but they were evidently not representative of the nation, and there is no alloy in our remembrance of that pleasant land. The proper record of the proceedings will be published in due course, but I may just touch on some of the work in anticipation of the fuller and more accurate report, though it must be with misgivings, for through language difficulties and other distractions it was not always easy to be certain what was being done.

The necessary preliminary business having been transacted, and a short address by M. Lepreux heard with pleasure, the Congress began with the opening speech of M. Guieysse bidding us all welcome, and prophesying for actuarial science, which had only during the present century won for itself a place, great progress and extension as it flowered and bore fruit in that to come. The first subject for debate, and it was one which appeared to have a special interest for those attending from the Continent, and perhaps to some extent foreign politics are involved in the question, was assurance against invalidity, a term used generally at the Congress to denote inability to work, whether by reason of accident, sickness, or old age. This was thoroughly discussed after reports from different countries had been "read", much information being given as to legislative talk or action thereon: a table of deaths from accidents in France, too, was on the walls of the Palais des Congrès. The difficulties of definition and classification, however, as between trade and trade—a tailor, for instance, would not be disabled by a sprained ankle—as between varying temperaments and willingness to work, and the old question of malingering, seemed to render any search for a general law almost hopeless, and all that could be done was to recommend the gathering together of statistics, as far as possible in the same form, with a view to their future use. A system now being introduced into Russia, by which an assured with participation surrenders his share of profits in return for freedom from premiums during invalidity and a right in that case to from 60 to 75 per-cent of the sum assured, may be noted, and it was rightly pointed out how inadequate and inequitable such a charge for such a benefit is. A pleasant proposition that whatever happened the actuary should be free from responsibility failed to secure assent.

An excellent paper by Mr. Ryan—perhaps one of the best submitted to the Congress—prepared the way for the consideration of valuation and distribution methods, but it was certainly

disappointing that, except for a dissertation on systems in use in the Netherlands, nothing else was written on the subject. Nor did the speaking add much to our acquaintance with continental practices, either of valuation or profit division, of which it would be very interesting to learn more, and the third premium used by our neighbours—the *prime d'inventaire*, which includes, with the provision for risk, a considerable allowance for office expenses—was hardly mentioned. The interesting fact that a reduction of the rate of interest from 3 per-cent to 0 per-cent adds 1 to the annual risk premium per-cent for a whole-life assurance is worthy of record.

Extra charges for foreign and sea risk did not excite a great deal of interest, and it was frankly admitted that the more recent standing of most colonies other than British led to less knowledge of the matter abroad than in this land. A bold inclusion of the United States among our own colonial possessions was restrained: but to English minds, the exceeding caution bred of the proprietary character of nearly all the French companies (as well, possibly, of the increasing proportion of non-participating policies), and leading to their reluctance to undertake business of which little is known and which might risk a diminution of dividends, was surprising; as also the suggestion of special companies for such assurances and for study of the subject. Useful tables were given, particularly by Mr. Chatham.

Additions to premiums because of profession or trade brought out again the extreme difficulty of classification, especially with reference to the status of master and workman and to change of occupation, any general requirement of a registration of such changes being, not unnaturally, considered impossible, and the right of a man to begin life in one capacity and die in another being freely conceded. Efforts, however, are in progress in France on the part of the Government for the construction of tables of occupation mortality, and others are being made with respect to Paris only of which certain curves were submitted for consideration. The influence of good or bad health in the choice of a trade was not forgotten, and the general opinion appeared to be that, so far as assurance business is concerned, not much discrimination can be exercised at present, save as to the liquor traffic. As to this, Mr. Barrand's evidence of selection in the differing publican mortality rates for lives, otherwise of the first class, who have taken endowment assurance, similar lives with whole-life assurance, and policies

of the latter description on under-average lives, was interesting. But a valuable essay by Mr. McClintock pleaded for special researches, whether as to trades or characteristics, rather than general tables as the outlet for actuarial energy in the future; and he mentioned also his preference for Dr. Farr's Healthy English Districts Male Life Table,\* which shows percentages of mortality equivalent to about seven-eighths of the corresponding percentages according to the American Table, as the model, or standard for comparative purposes, of good risks. He also urged the need of tables based on the experience of monetary losses rather than of deaths alone, a subject which has much more attention on the other side of the Atlantic than on this.

The next question was the valuation of marketable securities, and much diversity of opinion was manifest, ranging from an illogical German requirement that the market price of the day should be adopted if lower than the cost price but otherwise the latter, to a curious Italian system of basing the value entirely on a capitalization, at the rate of interest used in the investigation, of the income produced by the security. To leave investments at cost price, save for any writing down of those which were bought at a premium and are terminable at a fixed date or by drawings, and provided always that there is a sufficient Investment Fluctuation Fund and that the lower estimate is chosen in any doubtful case, seemed generally approved. It was also pointed out that due regard must be had to the fact that we are dealing with going concerns, and that a mere Stock Exchange price at a given moment, dependent on chances of trade, political considerations, and abundance or scarcity in the market, is no sole criterion of the worth of an asset. This is true, and while it must occasionally be remembered in cases of depreciation, it is especially important that it should be recollected before any distribution of surplus when values are high.

After this subject had been disposed of, diverse matters engaged the attention of the Congress. Mathematics, theory and practice, initial reserve values, sickness experience and Japanese progress jostled each other; but of principal importance was our own Dr. Sprague's memorandum re-arranging and slightly expanding the Universal Notation established in London in 1898. Besides animadverting on one alternative symbol

\* *J.I.A.*, ix, 204.

already authorized, he pleaded especially for a symbol for an assurance on one life against another and during a certain period after the latter's death; and for international recognition of a letter or number at the upper left-hand corner of a symbol to represent a corresponding addition to the age or ages specified at the lower right-hand one. To these Mr. Ackland added "E" for the number exposed to risk and " $\theta$ " (from *θάνατος*) for the died, as already used in connection with our present mortality investigation, the former being sufficiently distinct, it was maintained, from the symbol for an endowment by reason of its having no subscript on the left: and M. Bégault asked for a means of signifying the duration of validity (the opposite to invalidity as defined above) to be used in conjunction with ages, much as the symbol for a fixed term of years is now—a very desirable addition in view of the increasing attention which is being given to all questions of this kind. It is probable that the meeting would have been prepared to adopt these alterations at once; but, in view of the feeling of the last Congress against any change without long premeditation, the importance of the subject, and especially the possibility that, while we were agreed on these points, a precedent might be set for a similar vote on some other occasion when the advantage of the variation was less certain, it was thought wiser to leave the matter for the decision of the next assembly. At the end of this sitting, already sufficiently miscellaneous, a minority was anxious to pass a resolution in favour of uniform State supervision of life assurance affairs—the mice, as it was happily described privately, to approve a trap—but, after considerable debate, the motion was ruled out of order as not being on the list of agenda for the day, and as having been adversely decided on by the Brussels Congress in 1895.

The final meeting began with the expression by M. Millerand of the thanks of the Government to those who had attended the Congress, and of its recognition of the value of the actuary's services to the State. Many useful historical papers, though not perhaps conveying very much new information, were then submitted as to the progress of our affairs in different lands, and it was gratifying to see how well ahead our own dear country is in most things that appertain to the profession from which we "do seek to receive countenance and profit." It was agreeable also to find that Great Britain is generally (and rightly) recognized as the home, and our race as the leaders, of the science, and this Institute as the noble mother



of all similar bodies elsewhere. Long may it so continue: and long may we 'of duty endeavour ourselves by way of amends to be a help and ornament thereunto'! The next congress was fixed for New York in September 1903, and Berlin was fore-shadowed as the meeting-place for the fifth; the President wished us a kindly farewell, and our thanks to him and others were cordially tendered; and the Third International Congress of Actuaries was over.

And as to the value of such a conference? Of the social utility too much cannot be said, for beside the congress, there were during the week the relaxations which seem to be as much a part of any well-conducted gathering of this character as the games are of a public school. In these French urbanity and French taste were everywhere to be noted, and while this is not the place for a recapitulation of their elegance, I may call attention to the advantages of such entertainments in bringing strangers face to face, in the renewal of old friendships and the making of new acquaintances, and in the opportunities for pleasant intercourse—between rivals possibly but yet brethren—which were undoubted at Paris and highly appreciated, based as they were on a hospitable welcome it is a delight to again thankfully acknowledge. But can the usefulness of these meetings be increased, and can they be made more stimulating and helpful from a scientific point of view? The regular attendance and earnest attention of some of our continental neighbours seemed to show that they take them very seriously, and our being deprived of sticks and umbrellas before entering the hall hinted that in similar cases feelings may have been found to run too high. We, however, are a practical people, and found the double translation, so that everything was set forth in French, English and German, very wearisome, and I wondered from time to time whether the translation into German could be given up without affronting the public spirit of that nation, seeing that, to their credit be it said, all the Germans probably spoke French, and a great saving of time could be effected if French and English only would suffice, as they did at Brussels five years back. All papers, too, should be printed and circulated a week before the Congress—I know that efforts are made in this direction, but it should be a *sine quâ non*. Reading the papers was mostly impossible from lack of time, but the short summary by the author, with its translation into two more languages, was troublesome and almost useless as a means of information,



without contemplating how far from brief some writers were in their abridgment. And concentration in speech and a limit in length are necessary in the interests of general discussion, for more than once time was wanting, and a matter had to be disposed of in spite of others being anxious to say something and still others having something to say. Possibly a reduction in the number of subjects is the proper way of effecting this improvement, but it seemed a pity to have brought people from so far and then let them miss something of the wisdom that might have been forthcoming. A more difficult thing to arrange is that each country should exercise a selection of speakers, for occasionally representative men lacked a hearing, while others less well known, or at any rate of less eminence, seemed to be often talking. The incident, too, as to State surveillance already mentioned, called attention to the need of requiring (at least) three days' definite notice of any resolution to be proposed, except for the ordinary formal business; though an American opinion that there ought to be a Rule of Congress like Article XII of their Actuarial Society's Constitution, which sets forth that "No resolution expressive of opinion shall be entertained at any meeting", deserves consideration, and indeed we always act here as if such a regulation were among our bye-laws. Should there be anything in these suggestions, the Permanent Committee will doubtless take steps to procure the needful reform.

The writing and speaking on Old-Age Pensions, which seems perpetual, is another event of the year, for I suppose it may be so called, as I could hardly include among our *wants* the establishment of the proposed payments commonly called by this name: I cannot but believe, moreover, that many of those who now talk so heedlessly would be led to the same conclusion if they would carefully consider the problem, free from political prejudice and uncontrolled sympathies. One would have imagined that the cost of the five shillings a week to all comers of sixty-five years of age and upwards would have been immediately prohibitive, especially when recollecting that the increased taxation to provide it must include further duties on articles of daily consumption, so that the purchasing power of even this small allowance would be diminished to the extent of the sum thus transferred from one pocket to another. And if the grant be not to all, how especially grievous would be the position of those whose savings just keep them above the line for succour, and who do not give away to friends a sufficient sum to bring them down to the

qualifying level—I say nothing as to an entitling minimum of good character, for the impossibility of any such circumscription would have been, I should have thought, sufficiently apparent, were it not that it is still advocated by some. Besides, with the improvident always asking for more, with political parties bidding one against another in what will have something of the nature of a bribe, and with vote-seeking candidates making promises to be fulfilled as they may, how long would any fixed limit as to pension be allowed to last (and how long, too, would any anticipated saving in poor rates remain) while the many were being taught to be beggars, and the morals of electorates and those who woo them corrupted? The operations of the Friendly Societies would be injured, and who would willingly harm these training-schools for greater things that knows how excellent is the business capacity their management calls forth, or the public spirit with which splendid sacrifices can be made for the general good—witness the amassing of large sums for the attainment of solvency, or the recent grant of money and gifts in labour which have resulted in the new Manchester Unity of Oddfellows' Tables? \* And all for a mere name, for unearned gifts from public funds are not the less Outdoor Relief because they are called Old-Age Pensions; and any suspicion of discredit which may now attach to the one would soon be affixed to the other (though doubtless in a modified form from the larger numbers concerned), as is evidenced by the word “pauper”, which did not in former days convey the stigma of the present. That everyone has a right to a pension (to use the word in the customary manner) cannot be admitted; and the common argument (put into somewhat different words) that because the soldier or civil servant, whose remuneration is arranged on the basis that a portion will be deferred for his later years, enjoys this deferred pay under the name of a pension, therefore every labouring man, who has already taken (and spent) his full wages, may properly afterwards claim more from the State, loses sight of the fact that in the one case the employer rightly has to find the postponed amount, whereas in the other, additional hire is to be afforded by somebody else, as indeed it would have to be, for the many changes of service would ordinarily make any other scheme impossible.

But if we see the impracticability of certain wild proposals,

\* *J.I.A.*, xxxv, 268.

and the danger not only to all incentive to thrift, but to the proper pride of those who are commonly called working men (though that definition does not include many of the hardest workers), we are not unmindful of the hard lot of the aged poor who have done their best in their day but to whom circumstances have been unkind. To us, surely, the most pathetic of all so great sadness is when it has happened that the little provision has been swept away by the failure of the fund which should have been in waiting when the shadows are lengthening: and yet it is a fatuous prevention of such a trouble to discourage the attempt to save at all, and to weaken the incitement to do the best for the future by relieving of every penalty the man who never makes any effort of the sort. The high spirit of the race is of greater importance than the sorrows of the few, unfeeling though it may seem to say so, but it were terrible if these should fail to be alleviated by every improvement that can be obtained in the administration of the present public relief of want, and by all charitable agencies which supplement the bare provision of the law.

Two things are, in my judgment, urgently needed in furtherance of thrift among, and in aid of, the classes in question. One, that the legislature should protect all provident funds in the hands of trade unions from any association with strike funds. An insurance company transacting other business besides that of life assurance has to keep receipts for life assurances and annuities in a separate fund, "as absolutely the security of the life policy and annuity holders as though it belonged to a company carrying on no other business than that of life assurance", and other bodies ought to be under a similar obligation in respect of accumulations of a similar nature. Any investment of such accumulations with, or grant or advance out of them to, a trade-union organization, should be prohibited, so that the money to carry on a strike would have to be raised for that purpose; and equally should any dependence of provident benefit on belonging to or acting with the union be forbidden. A working man ought to be defended from losing his savings either by their dissipation during an industrial war, or by his expulsion for failing to go out on strike when called on, for doing piecework or infringing inhibitions of that kind, or, in fact, for guiding himself in any matter according to his own and not others' wishes. This proposition must not be understood to be either against or for strikes. Let a man strike or not as he chooses, but let him understand the cost; and let

him have liberty to take the action he thinks best for his mates and himself, without any chance of the penalty, if he desire to work, that he must forfeit, with the membership of his union, the provision for sickness and death to which his payments of, perhaps, years should entitle him.

The other of the two things is the supplying of means by which any provident fund for the poor should be able, at the request of its managers, to obtain free of cost an examination into its position, and a certificate of its solvency if such be the case. No one need then suffer loss because those to whom he entrusted his treasure were ignorant or foolish, or worse; and none of the immense number of kindly-disposed persons throughout the length and breadth of this land need then hesitate to advise, solicited or unsolicited, those whose welfare they have at heart how to put by something at the time of life when they are able to do so. I shall be told, doubtless, that any public certificate of solvency means practically a public guarantee of engagements, but this does not necessarily follow, though consideration (without imitation) should be given to the French system of national guarantee. The position I have in my mind is more that of a mutual life assurance office, in which the control rests with the Members, and yet is delegated to the Directors, who, under professional advice, guard the stability of the undertaking, and from time to time may have to recommend, as has happened of late, the strengthening of reserves and (less frequently) the varying of contributions with a view to the requirements of the future. If all this is a matter of course with such societies, I see no reason why a public department—a sympathetic one, I trust—should not act somewhat in the manner of Directors in giving information and advice to those concerned for the institutions in question, and calling for any needful efforts, which, it may be hoped, would be generally made. The possibility of this is borne out by what has been already done through the unassisted exertions of the shrewd men who rule certain of them, but how much more could be achieved if they were able to point when necessary to an official intimation, instead of to a private opinion of which we indeed know the value but not the world at large. With provident funds, certified to be sound, in operation, it may well be anticipated that private munificence, which now seems so much limited to endeavours to settle the housing question—not always with success so far as the intended recipients are



concerned—would supply the means for the *augmentation* of benefits honourably bought and paid for by those who are to enjoy them, much as at present a similar project is worked for the good of the clergy. Thus the careful would be helped and not the spendthrift, and if it be objected that such a scheme looks to what is termed charity—another beautiful word with a connoted sinister meaning—surely a gift is a gift whencesoever it comes, and a gift warm with love of the poor is a better thing than the cold benevolence of a statutory grant. In passing I may remark that such an addition by percentage or otherwise to self-made provision would seem to be the least harmful way in which any public subvention could be applied, but I am no advocate for pecuniary help from the State with all its dangers.\* I have been supposing a variety of provident funds, but there does not seem to be any insuperable objection to the State also (as is possible in France) accepting gifts of money in trust for such purposes, just as it now gladly receives works of art, for instance, for the benefit of the public; and donors might then endow the poor at large, or any particular class, or even person, with an augmentation of benefit. If the gratuitous services of the Post Office could be secured as the channel for the weekly payments, so much the better.

It is to a system of deferred annuities (to begin at varying ages according to the circumstances), augmented in the manner indicated, gradually making its way, that I would look for a solution of the problem without any violent upheaval or sudden great economic change, so foreign to the English character. The plan, however, would be certain to meet with opposition because premiums must not be returnable, for otherwise immediate necessity would too often lead to withdrawal, though in the event of lapse after a reasonable probationary period, a proper value might with justice be allowed in the form of deferred annuity. This mode of thrift, too, is said to be distasteful to the working man, but if it were commended by the eloquence of statesmen and by his leaders, the more prudent among

\* Since writing the above, I have seen mentioned a Belgian law of May last, which authorizes yearly to certain purchasers of small old-age pensions, grants, speaking broadly, of 60 centimes in respect of every franc (up to 15 francs) paid in by them during the year. On the credit reaching a sum which will buy an annuity, beginning at 65, of 360 francs, no further allowance will be made. It has also been stated that the German Empire, by an Act of this year, subsidizes with one hundred marks persons who have made a qualifying number of weekly payments for pensions.



them, of whom we are specially thinking, would doubtless make a beginning as they more and more perceived the advantages offered, when others, it may be hoped, would become used to it and be taught to like it, and from their sporting tendencies might eventually get to enjoy backing themselves to live. With the establishment of such a scheme for those who would avail themselves of it; with a continuance of the improvement gradually taking place in the accommodation and arrangements of workhouses (emphasized by the excellent building of the St. Olave's Union opened by the Prince of Wales in July last, as well as by the more recent suggestions, some hardly practicable, of the Local Government Board to Boards of Guardians); and with all possible amelioration in the treatment of the sick and aged, and especially that any administration of outdoor relief should be by the official of a central body (unless we may expect permanently the better class of local representatives which has been promised by recent legislation), something at any rate would have been done for the poor we have always with us.\*

Other events of the year may be summarily dismissed. The investigation into the mortality of assured lives and annuitants, which now approaches completion, can for the present go unsung, because we have heard of it from time to time, and, with three volumes already published, and another coming out in a few days, it is better to leave the matter to be dealt with as a whole when the monetary values have made their appearance, and the doings of the Joint Committee, and the methods of graduation, have been set down in black and white: I cannot refrain, however, from saying that few who have not served on that Committee will be aware how great is our debt to Mr. Ackland and Mr. G. F. Hardy for their labour of love, and especially to the former in view of the length of his services. And similarly, any consideration of South African war risks (of battle and disease) must wait until the necessary data are forthcoming: while the development of employers' liability needs a paper to itself some day. The Companies Act, 1900, affects companies registered under the Companies Acts in its demand

\* I venture to add the suggestion that in lieu of the small pensions now granted, for example, to sailors and soldiers, a plan of, or at any rate an option of taking, deferred (and larger) annuities might be formulated; and indeed, if the digression may be pardoned, it is possible that others, such as officers compulsorily retiring at young ages with a pittance, might prefer a pension deferred until they have ceased to earn a salary in the vocations to which they turn their abilities, but then of a more satisfactory amount.

for an election of *all* auditors every year, and for an Auditors' Report, to the effect specified, to be read before the company in general meeting. The attempt to pass the Prevention of Corruption Bill (as it is connected with the payment of commissions) need not be discussed now, for with my official employment it would be unbecoming, and I might fail in my desire to avoid undue controversy among ourselves. I would only venture to urge the great distinction to be drawn between commission paid to a solicitor or personal friend whose advice has been sought by the assured, and the well-earned remuneration of an appointed agent who makes it his business to hunt up new proposals for the company of which he is known to be the representative. But, after all, the counsel of perfection in this matter also is

“ Let every eye negotiate for itself,  
And trust no agent.” \*

The allotment of Mr. Chisholm's (more recent) prizes, and once more of a Brown prize, have come otherwise under your notice.

So much for the past, but what are our wants for the future? Certainly an amendment of the Life Assurance Companies Acts; but while we are waiting for this, is it impossible that something might be done by agreement with the Board of Trade, acting under the power given by the Act of 1870 for altering the forms in the schedules to it, for the purpose of adapting them to circumstances, or of better carrying into effect its objects? “Give and take” would be necessary of course, but both parties have, or ought to have, the same desire, and while some of us already supply information which could not be enforced, and yet without which no external actuary could come to any conclusion as to solvency, there are probably other matters in which we might be willing to meet the wishes of the Board of Trade: a bargain of this description has, I think, already been made by one society, and such an example might well be followed. For instance, the Board, at the end of 1887, sounded the companies as to their willingness to give the particulars required by the first five columns of the Fifth Schedule's Summary and Valuation every year, instead of only at intervals

\* *Much Ado about Nothing*, Act ii, Scene 1.

of years, so that the total assurances of the country at any time might be more accurately estimated, and it is probable that nearly all of us have the figures and could furnish them without difficulty. Why should we not do this in exchange, say, for relief from that most annoying, and almost useless, requirement of stating the total premiums received on assurances other than for the whole term of life? Again, it would be very convenient were it permissible to schedule all ordinary assurances for the whole continuance of a single life in two classes only—participating and non-participating—and the corresponding premiums under ages if payable during life, or, if subject to limited payments, in groups according to the period to run; increasing and decreasing, and other special premiums, being somewhat similarly dealt with, though if there were many of them a different treatment might be necessary. Such a course would be logical, for assurances under the extreme form of limited premiums, namely only one, do not find their way into any separate category; and if this plan were adopted we might fittingly show as a liability, with the value of the sum assured, a loading reserve covering the duration of the policy, the value of the entire office premium being the asset. In exchange for this concession, we could agree to make a return of endowment assurances classified according to date of maturity, without which an unofficial valuation is impossible, and this also is wanted for our own purposes, and something of this nature would certainly have been prescribed had endowment assurances been as much in vogue at the time of the passing of the Act as now. Should arrangements like these be feasible, the intention of the Act would be promoted in giving greater facilities to an actuary for forming an independent opinion as to the financial state of any company.

Perhaps we might be able also to settle with the Board of Trade how the average rate of interest is to be computed. Many companies give an average based on the mean funds after adjustment for the year's interest income; but the words of the schedule are so clear that this can hardly be justifiable, and I agree with those who maintain that the average required is not one that is to be based on the past by a simple calculation at everybody's hand, but a prospective one of something only within the company's knowledge, there being, too, a superiority in this view in that it prevents any extraordinary payment of interest during a year from causing too favourable a reckoning of future prospects. Nor does the ascertainment give very much trouble if a column be added

to the credit side of the ledger, and the half-yearly charge for interest inserted when an investment is made, a proportion being deducted against every repayment, and the remainder taken out simultaneously with the balance of account at the end of the year, the totals being then summed and a ratio found. This method has the advantage also of rendering it easy to watch in the office the average produce of different classes of securities, as well as of the total assets. But my point just now is that, whatever practice be adopted, it is important that we should all use the same.

Another matter for determination would be as to the large sums not seldom given in the Summary and Valuation as "adjustments", which word could never have been intended to include so much. Particularly, perhaps, adjustments because of claim acceleration; and, moreover, when these are based on the "net liability" as is common, it is misleading so to state the amount, and ignore the increase in the risk premium thus assumed and that therefore the margin shown between the values of the full and risk premiums is not reserved. The date of payment of claim is an incident of the assurance itself, to be considered with the rates of mortality and interest, and it is easy to increase to the extent necessary the values of the sums assured and of the risk premiums also, instead of giving a separate item of special reserve implying a supreme caution. Similarly, any variation from the customary assumption of the even falling due of the premium income should have attention in stating the value of the premiums, and not by itself afterwards: and is not sometimes an allowance for days of grace forgotten, although an interval for proof of death and title has been remembered in deciding on an average date for the claims?

Other needful changes, however, are beyond the powers of the Board of Trade, as, for example, that a company with annual valuations should be relieved from making returns under the Fifth and Sixth Schedules more often than on a concurrent date once in every five years; for not only may the class of companies referred to be reasonably spared the additional labour, but at present the three years' figures generally given by them are sometimes unfairly compared with the more common five years' figures of others: and it may be added that if ever the two great offices which still maintain a septennial period should reduce the interval to a quinquennial one, the benefit in point of symmetry would be great. Nor, once more, are the yearly



Revenue Account and Balance Sheet usually accompanied by a copy of the last Fifth Schedule return, and this requirement might well be waived. And the tables of mortality and rate of interest in the rules scheduled to the Act of 1872 for valuing annuities or policies in a winding-up would not be acceptable now, but these can be varied without a new Act should it become necessary, though it is to be hoped it never may.

But if these things are beyond the Board's power, it could, and ought to, take steps to require the deposit of £20,000, as well as the accounts and statements, from all persons who grant assurances on lives. Questions have been asked in the House of Commons on the subject, and officials, as is not altogether without precedent, were not aware of a far from infrequent practice, so that beyond the posting of a cautionary letter at Lloyd's, nothing appears to have been done. Probably much of the business in dispute is not of the best class, nor the rates always remunerative, but without desiring to check any proper competition, it is not right that others should make use of our calculations, and sometimes trust also to our admission of claims, and yet be free from a control to which we have to bow. Very often, no doubt, it is from ignorance that the statute has not been obeyed, but it is important that the law should be observed, and for the good of the public that all should be on an equality.

Further, with all the light we have to throw on our affairs, those of us, and they are many, who carry on business under the Companies Acts, must be delivered from the necessity of displaying in our offices the statement in Form D of the First Schedule to the Act of 1862—I never knew a copy to be asked for by a member or creditor, with or without the sixpence. Compliance is practically impossible, and the statement is ridiculous so far as insurance companies are concerned, considering the full particulars in our returns to the Board of Trade.

Another crying want is a simplification of the methods of assigning policies, but to this attention has been previously called, and it need not be enlarged on now. I am still, however, clearly of opinion that such assignments should be compulsorily registered much in the way transfers of shares are, with a further provision for cases of mortgage when desired. If this can be done in the colonies it can here; and it is not fitting that, when we are asked who is entitled to the benefit of a policy, we can only say that we have received certain notices, but that the



title depends on the deeds to which they refer, which may or may not be properly drawn. Irregular and home-made, and unstamped or wrongly-stamped documents, with informal intimations, add other complications, and the poor man wonders what there is about life assurance to make its changing hands so exceedingly confusing. Doubtless such a procedure should only be obligatory for assignments made, or at any rate for policies granted, after the passing of such an Act, but with a provision for others to be voluntarily brought under it, I have little doubt that the double practice would speedily tend to become one.

A permanent Census Department we want also for the more frequent obtaining and digesting, and the continuous watching, of statistics of, among other things, 'the time to be born and the time to die', but this we lately urged in our Memorial to the President of the Local Government Board,\* and I will only, therefore, lay stress upon the desirability of an actuary being in charge of it. He would not have less aptitude than other statisticians in collecting information and dealing with it afterwards; while he may be expected to be more deeply impressed with the importance, say, of accuracy in setting down ages, as to which greater care is urgently needed. I have heard a high authority publicly maintaining that errors of this class are not of much consequence, because mistakes would be as likely to occur on the one side as the other, quite forgetting that many are by no means accidental, and that for some which are there has been a strong bias in a particular direction. The mortality inquiry now going on has discovered a prodigy who was blessed with seven dates of birth, and five reports of a survival extending for two years after two notes of his death;† and with such and many other not quite so violent irregularities before us in spite of all the efforts made to secure precision, we are the less likely to place undue reliance on the public records so far as ages are concerned, bearing in mind how indefinite and shadowy are the ideas of many, even when they wish to tell the truth. And talking of ages, there is a minor hardship in the withdrawal here of a long-exercised privilege of looking at the birth and death registers for a fee of one shilling: and an irritating one in the absurd rule that anyone living in London or its suburbs who

\* *J.I.A.*, xxxv, 362.

† *J.I.A.*, xxxiv, 304.

needs a certificate must waste the time and energy of a personal application at Somerset House while a countryman can get one by post.

A widely-spread want is relief from having to endorse cheques drawn to order which have been crossed to the account of the payee. A trifling one is that a corporation which does not issue the customary certificate on a transfer of stock should be required to verify from time to time, without charge, a statement of the amount standing in the names in question. Why a few public bodies—at the risk of a fraud now and then and in opposition to the practice of an enormous majority of companies—persist in maintaining their own books as the sole evidence of a holding I have never understood; but at least they might fairly be compelled to revert to the practice, which was until recently the fashion, of assisting auditors and others by freely supplying an occasional authentication.

Last of general wants I would mention a large revision of the income tax provisions by a statesman with a broad mind and a resolute will, who will cut himself adrift from the traditions of the Department, and insist that it shall deal with the public as one man of business deals with another—as its friend and servant, and not as a grasping antagonist.\* The various legal decisions as to income tax due from insurance offices show how confused and unjust are the existing arrangements. If it be desired to tax provident institutions we can only express our regret at so short-sighted a policy, but let it be done openly and plainly and not by any side-wind; and let it be fair, so that the particular circumstances of a company, its constitution or the character of its business, do not give it an advantage. And I, for one, wish that the troublesome allowance in respect of premiums to the extent of one-sixth of an income might be abolished, as failing to effect the relief intended through being inequitable and insufficient. Inequitable, because those whose income is derived from property and investments obtain an assistance intended for the wage of work; and others, too, who have parted with their policies, may

\* Such a petty mulcting as lately on the conversion of Jamaica Railway Bonds into Colonial Government Stock, in the deduction of income tax at the present rate of one shilling in the £ on interest which had only been recovered in the current fiscal year though it became due when the tax was at eightpence, needs for its appreciation but a consideration of what would have been likely to happen had the position been reversed. The treatment of certain persons as to rebate of income tax in respect of portions of premium advanced by the company is another case in point.

yet obtain the abatement, though this last might be greatly checked (and trouble saved ourselves) were the production of the receipt itself, instead of a certificate of payment, insisted on by the Inland Revenue authorities. Insufficient, because some who live by their labours are not able to effect policies, and most invest only a part of their savings in assurance of their lives so that their premiums do not come up to the sixth. Many, too, do not know of the privilege, perhaps partly by our fault, and many fear difficulties and trouble in securing it; while some, through concentrating their premium payments within certain years, lose the rebate on a portion of the amount then, and, for want of any system of averaging, are unable to recover it later on when the annual charge is less or non-existent. Why should not the whole system be abrogated, and a simple measure of alleviation granted by only charging income tax on five-sixths of the amounts of personal earnings, salaries and pensions returned under Schedules D and E? Or there might be a sliding scale, with an increased allowance for small incomes, as there is in respect of the deduction for repairs permitted from the gross rating of small houses; but the worker should feel that the difference between the recompense of his energies and a permanent income is fairly recognized, and in one way or another it ought to be made impossible for a man's taxation to be increased because his health is bad, or he prefers one form of investment to another. It may be argued that the present plan tends to bring grist to our own mills, and to a certain extent this is probably true, but to have our wares supported by bounties, and to profit by injustice to a deserving class, is beneath the dignity of the calling we hold in high esteem. Doubtless the proper moment must be chosen for the change, but presumably the income tax will not always remain as heavy as now, and it is to be hoped that, when a lightening of the burden becomes possible, a Chancellor of the Exchequer will arise who will remember that something would be saved were what I have called the inequitable to cease, though the ending of the insufficient would be to his cost; and, in spite of the retention of a nominally high rate, will have courage to make the alteration, and earn by his action the gratitude of a large section of the people—mostly with votes, too, even as the others.

But narrowing our outlook to professional requirements, though it is a thorn to grasp, one of our great wants is the

definition of an actuary and the setting apart of the title for him. It may be a small matter that so many have no idea of the functions of an actuary, and that we find ourselves sometimes confused with strange company in the popular mind; but it is not a small matter that there is no protection against the name being used by anyone, whether competent or incompetent.\* We want no "trade union", nor that a man shall be prevented from computing and advising if he find those who will trust him, but it ought not to be a grievance that the appellation in the United Kingdom should, after a short interval, be exclusively reserved for the Fellows of this Institute and of the Faculty of Actuaries in Scotland. Doubtless the difficulty has greatly arisen from the change of meaning in the word itself; but it is to be hoped that so well-known an official of so conservative a body as the Actuary to the Lower House of Convocation of the Province of Canterbury would, for the public good, consent to a designation more in accordance with modern meanings, and the "actuaries" of the various savings banks should follow suit. A reservation in favour of any persons now *bonâ fide* practising it might be necessary to allow with proper registration, as was done in the case of the medical men many years ago though the wisdom of this was questioned, but our own profession equally needs delimitation, for, in spite of the dangers of unqualified assistance being more apparent in the case of bodily ailments, it is not to be gainsaid that financial prescriptions are sometimes of capital importance. I know that I am asking a hard thing, but for fifty years it has been more or less discussed,† and if the interests of the public require the change, the change will have to come.

Is it not a fact, too, that the actuary deserves a higher meed of public recognition and encouragement than is customary in this country? It was not too much in Paris for a Cabinet Minister to give up an hour for his courteous testimony to the Government's welcome and appreciation; and indeed it has appeared at these congresses that the actuary has more honour in foreign lands than in our own. It may perhaps be thought exaggerated, but bearing in mind the enormous funds (£250,000,000) largely dependent on the actuary's skill, I

\* The Warden of Merton (Hon. Geo. C. Brodrick), in an article on "A Nation of Amateurs", in the *Nineteenth Century* for October 1900 (No. 284, p. 531), thinks that "Special branches of business, like those of actuaries, "chartered accountants, and engineers, are guarded against incompetence by "strict professional tests", &c. It is to be wished it were so.

† *J.I.A.*, i, 114.



question if the services of some of the great scientific societies—grand foundations indeed and rightly subsidized by the State—are more important to the welfare of the public than those of our own body. Is it beyond hope also that some day an actuary will be found in the House of Commons? There are many occasions on which his opinions would be of use, and it might be expected that his voice would be raised against retrograde legislation such as most of us deem certain Acts of recent times—as to vaccination for example. With the higher appreciation, it may be anticipated that the assistance of the actuary will be sought in official positions other than those connected with life assurance companies. We should have been glad to see an actuary as Registrar-General, as urged in a letter to the *Times* of 13 January last; and vagaries now going on seem to show that those who are concerned with the collection of estate duty are in want of actuarial help. The Chancellor of the Exchequer, it is understood, has been accustomed to consult the Actuary to the Commissioners for the Reduction of the National Debt; and the Board of Trade seeks advice from another of us as to life assurance accounts; but it would be thought that both the Treasury and the Board of Trade, as well as other Departments, could well employ the time of fully-qualified actuaries of their own: and even in administrative ability alone, the War Office might possibly learn something from Fellows of the Institute whose methods of controlling an army have been conspicuously successful in a great building not far from this Hall. An actuary as an assessor of courts of law seems a revolutionary proposal; but a newspaper should have one among its staff; and there are many other places, permanent and temporary, which an actuary is specially fitted to occupy: the recent inclusion of one of my brilliant predecessors in the advisory committee as to the affairs of the Great Indian Peninsula Railway Company gave evidence also of an understanding by the mercantile world of the importance of the interests we represent.

As a bold suggestion I throw out the satisfaction it would be to many of us if the Institute of Actuaries and the Faculty of Actuaries in Scotland could be united. The happy fact that in the north certain functions, which in London form part of the general work of the Institute, are well discharged by the Actuarial Society of Edinburgh, makes it easier to hope for this conjunction; and no absolute bar to the formation thus of a single



body representative of the profession throughout Great Britain and Ireland would seem to exist, it being understood that the Council must always include a proper proportion of members from across the border, and that the two libraries must remain separate as at present, though probably with some useful inter-changing of volumes. If a complicated work such as is now being done by the Joint Committee on Mortality Investigation can progress without friction, and, as I can say on the part of our section, with great respect for the skill and judgment contributed by our colleagues from beyond the Tweed, it is a happy augury that the greater and less troublesome thing could be arranged in a somewhat similar manner, and I shall continue to hope for a consummation I may not see as yet. But, however this may be, the time has, I think, come for an agreement that, after a necessary interval of delay, the examinations for an actuary's qualification shall be conducted by delegates from the two bodies, that there may be but one standard of admission to the profession in the United Kingdom. When the mortality investigation has been completed, perhaps the same gentlemen who have toiled so well together might be empowered to find a basis for a scheme of this kind; and this having been fairly established, it is possible that the Actuarial Society of America might be willing to join our colonial brethren and ourselves in providing a single assay for the actuaries of all English-speaking races. This broader comprehension is, and will for some time be, but an idea, but the other I believe to be practicable, and its early accomplishment most desirable.

Then the constitution of our own Institute is not yet old, but there are some who question whether it has in every point fulfilled all the expectations which were current when the charter was granted sixteen years ago. Possibly, the tendency to the academic and the exclusive was not sufficiently guarded against in view of the stern fact that for most of us the great affairs of the rushing life of this London occupy more of our time than we can give to mathematical research, and that the bustle of a city life leaves but little leisure for the study, and for the quiet shades of Staple Inn. But I am sure that in this Institute ought to centre every requirement of our business as well as of our profession; and I always regret that it failed to take up as its own task the work now excellently performed by the Life Offices' Association. While the fellowship must be reserved exclusively for the qualified actuary, there are many whose gifts in life office management, and

in posts of that description, show that we should be wise to avail ourselves of their co-operation, and these I would endeavour to enrol among our associates. To reach the desired end, however, it would be important that it should be possible (not compulsory) to elect ten associates to the Council, and that not merely to render more attractive the associateship—already a sufficiently honourable grade well worthy of attainment—but that our deliberations may have a leaven of less distinctly professional opinion. That “The President and every Vice-President shall always be elected or appointed from among the Fellows” ought certainly to be maintained : but to prescribe that “There shall be a Council of the “Institute chosen from Fellows [and Associates] of the Institute “[so that not more than one-third shall be Associates]” would, I believe, increase its usefulness, and yet leave sufficient power on the professional side in case there should ever be any clashing of interests. From such a Council and the membership at large, for committees need not be confined to those serving on the Council, a very strong General Purposes Committee might be formed to consider, and report, and act too if need be, whenever any point in practice, law, or legislation of moment to our community arose. Later on, perhaps, a saving of the double organization might be satisfactorily arranged, and overlapping of energy and labour avoided by the one general body fulfilling all the purposes for which two, if not three, now exist.

It is worth inquiry, too, whether the procedure of our sessional meetings, which has been somewhat criticised lately, can be revised so as to encourage the diffident, to curtail the lengthy, and to suppress, if it may be so, all that is uninteresting and dull. With the facilities now granted for previous perusal, there would seem to be no justification for a continuance of the custom of reading papers, or the greater part of them, as a preliminary to their discussion, and the author might well be asked to give an epitome during a quarter of an hour. The debate could often be opened by one of the juniors among us to whom the duty had been assigned, leaving to a Member of Council, who had been a referee as to the suitability of the paper for our attention, the more difficult task of summing-up the arguments ; and if these two were each allowed a quarter of an hour, ten minutes each should ordinarily suffice for the rest of the speakers. If the President thought any consideration even then remained unexpressed, or had views of his own to expound, he could have the last word in proposing the usual vote of thanks. Such a scheme

might be tried for a session, and it could then be ascertained what modifications were required; but the alteration outlined, is, I fancy, more likely to win assent than a reverting to the later hour at which we used to hold our meetings which has been advocated in a distinguished quarter. And with a greater activity at our debates, if ever it should be practicable, as has been earnestly urged more than once, to have the Hall or (new) Class Room open daily during certain hours as a reading room for those who wish to study books only procurable by them here, and as a meeting place for professional friends, we should be carrying out to the full the aspirations of our founders and their successors, for we would fain see in this Institute the home of endeavour as well as the storehouse of the accomplished, and these in combination with all that is for the progress of our craft, and the well-being of its professors and learners in their individual and the corporate life.

Custom demands that before I end, I should say something to my many younger friends, although it is almost impossible to do more than repeat advice gracefully tendered on previous occasions. Time goes so fast, and it seems such a little while since I was one of the beginners: but if the years are inexorable, sympathies do not pass on so quickly, and, like those now around me, I have not lost touch with, nor am I ever likely to forget, the difficulties and desires of the generation springing into the vigour of life. It cannot be very long before you will be taking our places here, and one of you in this chair hoping to combine encouragement with counsel, so as to help forward the effort after perfection which must be the goal for the ambition of all. If I may put in a plea for one thing more than another it shall be for the humanities—the general culture, which, as well as the professional training, is necessary to the full man. This would have its value in the examinations, for there are those who now fail, not for want of erudition, but from inability to get out in the prescribed time a sufficiency of their lore, and in these probably with wider reading a greater power of expression and condensation would be developed, which would lead them on to success. Or again in after life there have often been emergencies when a fortunate recollection of some almost forgotten piece of knowledge has been of the greatest assistance in unravelling a problem of the present day. But I would scorn to urge my

point as a mere question of marketable commodity, seeing that the highest good of the science and the self is at stake, and duty compels that such capacity as we have shall be trained to the utmost extent that our circumstances will permit. Examinations (or rather the working solely to pass them) undeniably have a narrowing tendency, and it needs the vigilance of the strong to overcome this deadening influence, especially when it is borne in mind how wearisome it is to begin grinding on again after the due performance of official duties during the day; and yet we must, unfortunately, have examinations, for no other test has been devised to take their place. And mathematics are sometimes said to narrow also, and we must have mathematics. The onus, therefore, of overcoming the evil and acquiring the good must rest on ourselves, and we may be very sure of this, that the useful among us in active life will be the men of the world who, looking all round, "comprehend" their subject with the breadth of their view, always remembering (to make use of an old example) that two and two can make twenty-two as well as four, and that a knowledge of figures alone will be of as little real benefit as the unfortunate patient found the computations of the hospital orderly who not having a pill number five at hand gave him a three and a two. The earlier volumes of the *Journal* bear witness to the large range of subjects then considered properly within the reach of an actuary's skill, and it is for us to remember that we must maintain our hold over the ampler domain. Granting freely that science is everywhere tending to become specialized as the world grows older and more and more is discovered, and admitting, too, that the technicalities of our profession are now carried to a nicety never dreamed of—nor desired—by our forebears, there is yet no reason why in the deeper study of the particular we should forget the general, and it is to be hoped that our records will still at times be adorned with monographs treating of great questions of vital statistics, finance, and economics, in their connection with our own branch of learning.

If I may presume to give advice to those who have recently become Fellows, I would say take every opportunity of keeping yourselves up to the mark, for it is amazing how quickly knowledge and facility disappear into the limbo of the forgotten and the lost. There is nothing to this end like being an examiner, should the call to do service in this manner come to you; but see as well all the practice you can, and "devil", if you have the



chance, for some one in a rather different line of experience than your own occupation will afford. Attend our sessional meetings, for hopelessly dry as I confess I have occasionally found them, I never remember to have gone away and not learned anything. And take part in the debates. When the ice has once been broken, it is seen to be not so very difficult after all, and I am as certain that those who try will never lack support, as that if more is feasible in this direction the Council have only to be told of it and you will be met half-way. Offer something yourselves too, without being afraid of a humble beginning, for "he that despiseth small things shall fall by little and little." Perhaps it will be a letter or some useful table for the *Journal*, or a review of some book of interest. Or it may be you will try your mettle in an essay for one of the prizes granted from time to time, or in a paper to be read here. With more Fellows, and a larger proportion of members proved by examinations, the number of papers sent in does not tend to increase. If a subject does not occur to your mind, a fairly long list was given from this chair in 1890,\* and another last year by the President of the Actuarial Society of America which will be found in our library,† though when the wish has been crystallized into an intention, I think the subject will present itself without undue delay. And having well considered your subject and become sure of your ground, I would say have the courage, if need be, to take your own line. It is excellent in free discussion to learn the views of other and, very probably, wiser men, and to weigh them well; but this is an age of unions and of sending round to make inquiries, and not always as to important things,‡ and it is necessary to bear in mind that our responsibility is individual and not put in commission. Solomon is commonly quoted for the observation that in the multitude of counsellors there is wisdom, but he said safety, and most of us have had reason at times to note the distinction.§ So think out and carry out something, and forgive me if in all this I seem importunate, but shyness or a praiseworthy modesty so often keeps a man back from rendering justice to himself, to his own loss and ours too, that I am constrained to urge you

\* *J.I.A.*, xxix, 14.

† Actuarial Society of America—Papers and Transactions, vi, 183.

‡ I remember a solemn embassy to ask whether it was the practice when a prospectus was requested to give a proposal form too.

§ *Memoir of Augustus De Morgan*, Section viii, p. 223.



to do what you can for the good of the Institute which has done its best for you.

And indeed we have a profession of which we may well be proud. I have heard the actuary described as a cross between a betting man and an undertaker, and I understand the allusions of a sarcasm with less polish even than point. Yet ours is a noble and a useful vocation, and we pursue it in honourable recollection of the rights of our clients, and with much sincere regard for one another and far fewer asperities in our rivalries than are to be found elsewhere. We help the business man in his prudence, and the father as he cares for those around him who are dearer to him than himself: we do not make gains out of the losses of another, nor pander to the weakness of the foolish; and if it happen that the spendthrift trades on methods not designed for him, we can recollect that his case was worse in the previous days, and unquestionably the numbers of such are not to be compared with the hosts of those whose old age is comforted by the precautions of their youth, and of the widows and little ones through whose tears by the light of our labours the rainbow of hope begins to gleam.

*Non omnis moriar*\* was the confidence of the poet of old who truly knew so little though he may have peered beyond. *Non omnis moriar* may he say who for love of God and man is providing for the future of his own. *Non omnis moriar* shall be ours too when we hand over the burden we may no longer bear, and leave behind for a memory that to the measure of our ability we endeavoured something for our fellows and for those to come.

*On a New Interpolation Formula.* By PROFESSOR J. D.  
EVERETT, F.R.S.

THE two leading formulæ at present in use for interpolation by central differences are due to Newton† (*Methodus Differentialis*, Prop. III), though often called by the name of Stirling, who republished them about 20 years later. They may be written

\* Hor. Carm. iii, 30, Ad Melpomenen.

† Newton also invented the common formula in advancing differences, in which the coefficients are those of the binomial theorem. He gives it in Lemma 5, which follows Prop. 40 of Book 3 of the *Principia*; but its identity is veiled by a geometrical disguise, rendered thicker by reversal of sign in the definition of  $\Delta$ .

$$u_x = u_0 + x\Delta_1 + \frac{x^2}{2}\Delta_2 + \frac{x(x^2-1)}{2.3}\Delta_3 + \frac{x^2(x^2-1)}{2.3.4}\Delta_4 \\ + \frac{x(x^2-1)(x^2-4)}{2.3.4.5}\Delta_5 + \dots \quad (1)$$

$$u_{\frac{1}{2}+x} = \frac{1}{2}(u_0 + u_1) + x\Delta'_1 + \frac{x^2 - \frac{1}{4}}{2}\Delta'_2 + \frac{x(x^2 - \frac{1}{4})}{2.3}\Delta'_3 \\ + \frac{(x^2 - \frac{1}{4})(x^2 - \frac{9}{4})}{2.3.4}\Delta'_4 + \frac{x(x^2 - \frac{1}{4})(x^2 - \frac{9}{4})}{2.3.4.5}\Delta'_5 + \dots \quad (2)$$

$\Delta_1, \Delta_2, \Delta_3 \dots$  being the central differences of  $u_0$ , and  $\Delta'_1, \Delta'_2, \Delta'_3 \dots$  the central differences relative to the interval between  $u_0$  and  $u_1$ . In both (1) and (2) the odd terms follow a different law from the even terms.

I venture to propose a new formula, which has some advantages over either of these. It contains only even differences, and all its terms are of one type.

Using  $p$  in the sense in which  $x$  is used in (1), and  $q$  for  $1-p$ , so that  $p$  is the distance of the new ordinate  $u_p$  in advance of  $u_0$ , and  $q$  its distance behind  $u_1$ , the formula is

$$u_p = qu_0 + \frac{(q+1)q(q-1)}{1.2.3}a_2 + \frac{(q+2)(q+1)q(q-1)(q-2)}{1.2.3.4.5}a_4 + \dots \\ + pu_1 + \frac{(p+1)p(p-1)}{1.2.3}b_2 + \frac{(p+2)(p+1)p(p-1)(p-2)}{1.2.3.4.5}b_4 + \dots$$

$a_2, a_4 \dots$  being the even central differences of  $u_0$ , and  $b_2, b_4 \dots$  those of  $u_1$ .

If the abscissas of  $u_0$  and  $u_1$  are called  $x_0$  and  $x_1$ , the abscissa of the calculated ordinate  $u_p$  is  $qx_0 + px_1$ ; hence the first pair of terms  $qu_0 + pu_1$  would express the exact value of  $u_p$  if second differences vanished, the curve to which the ordinates belong being in this case a straight line. In like manner, it can be shown that when fourth differences vanish the exact value is expressed by the first two pairs, when sixth differences vanish by the first three pairs, and so on.

For subdividing the intervals of a table into 10 parts, the following table of coefficients of the first three terms in either of the two lines which compose the formula is useful:

First	Second	Third
·1	—·0165	+·003291 $\frac{3}{4}$
·2	—·032	·006336
·3	—·0455	·008895 $\frac{1}{4}$
·4	—·056	·010752
·5	—·0625	·011718 $\frac{3}{4}$
·6	—·064	·011648
·7	—·0595	·010442 $\frac{1}{4}$
·8	—·048	·008064
·9	—·0285	·004545 $\frac{3}{4}$

These values are exact; but, in the case of the third coefficient, it is not necessary in practice to go beyond three places of decimals.

In the following example,  $u$  is 1,000 times the antilogarithm of  $x$ , and the tabulated values of  $u$  employed are correct to the nearest integer only. The reader can verify, by the help of a small table of antilogarithms, our deduction of the second and fourth central differences.

	$x$	$u$	Second Diff.	Fourth Diff.
Data	{	2512	133	10
	{	3162	169	7
	{	3981	212	12

	$p$ or $q$	First Term	Second Term	Third Term	Sum of Three Terms
$u = 2512$	·1	251·20	— 2·19	·03	249·04
	·2	502·40	— 4·26	·06	498·20
	·3	753·60	— 6·05	·09	747·64
	·4	1004·80	— 7·45	·11	997·46
	·5	1256·00	— 8·31	·12	1247·81
	·6	1507·20	— 8·51	·12	1498·81
	·7	1758·40	— 7·91	·10	1750·59
	·8	2009·60	— 6·38	·08	2003·30
	·9	2260·80	— 3·79	·05	2257·06
$u = 3162$	·1	316·20	— 2·79	·02	313·43
	·2	632·40	— 5·41	·04	627·03
	·3	948·60	— 7·69	·06	940·97
	·4	1264·80	— 9·46	·08	1255·42
	·5	1581·00	— 10·56	·08	1570·52
	·6	1897·20	— 10·82	·08	1886·46
	·7	2213·40	— 10·06	·07	2203·41
	·8	2529·60	— 8·11	·06	2521·55
	·9	2845·80	— 4·82	·03	2841·01
$u = 3981$	·1	398·10	— 3·50	·04	394·64
	·2	796·20	— 6·78	·08	789·50
	·3	1194·30	— 9·65	·11	1184·76
	·4	1592·40	— 11·87	·13	1580·66
	·5	1990·50	— 13·25	·14	1977·39
	·6	2388·60	— 13·57	·14	2375·17
	·7	2786·70	— 12·61	·13	2774·22
	·8	3184·80	— 10·18	·10	3174·72
	·9	3582·90	— 6·04	·05	3576·91

Adding the last sum in the first batch to the first in the second batch, and so on, we obtain the following values of the interpoland  $u$ .

$x$			$u$
·41	2257·06	+ 313·43	= 2570·49
·42	2003·30	+ 627·03	= 2630·33
·43	1750·59	+ 940·97	= 2691·56
·44	1498·81	+ 1255·42	= 2754·23
·45	1247·81	+ 1570·52	= 2818·33
·46	997·46	+ 1886·46	= 2883·92
·47	747·64	+ 2203·41	= 2951·05
·48	498·20	+ 2521·55	= 3019·75
·49	249·04	+ 2841·01	= 3090·05
·51	2841·01	+ 394·64	= 3235·65
·52	2521·55	+ 789·50	= 3311·05
·53	2203·41	+ 1184·76	= 3388·17
·54	1886·46	+ 1580·66	= 3467·12
·55	1570·52	+ 1977·39	= 3547·91
·56	1255·42	+ 2375·17	= 3630·59
·57	940·97	+ 2774·22	= 3715·19
·58	627·03	+ 3174·72	= 3801·75
·59	313·43	+ 3576·91	= 3890·34

It will be noted that each "sum of three terms" calculated from  $u=3,162$  and its differences does double duty, serving both for the preceding and the succeeding interval. In an extended computation, the number of "sums of three terms" to be calculated is accordingly practically identical with the number of intervals, and the labour of calculation is only about half what it appears to be on the face of the formula.

All the above calculated values of  $u$  will be found, on comparison with a table, to be correct to the nearest integer; and this is the same accuracy that attaches to the tabulated values from which they are derived.

As regards accumulation of small inaccuracies of tabulated values, it has been pointed out by Mr. W. F. Sheppard—and is pretty obvious when pointed out—that a correct measure of the limiting amount of this accumulation, in using any particular formula, is obtained by reducing the formula to its equivalent in tabulated values of  $u$ , and then taking the arithmetic (as distinguished from the algebraic) sum of the coefficients of these tabular values. Treated in this way, the new formula, when

carried to three pairs of terms, is equivalent, in the very unfavourable case of  $p=q=\frac{1}{2}$ , to

$$\frac{1}{2\frac{5}{6}} \{150(u_0 + u_1) - 25(u_{-1} + u_2) + 3(u_{-2} + u_3)\},$$

and the arithmetic sum of the six coefficients is

$$1\frac{2\frac{5}{6}}{4} \text{ or } 1\cdot390625.$$

This reckoning takes account of all differences to the fifth inclusive.

The tabulated values, when, as in the present case, correct to the nearest integer, may have any error between 0 and  $\cdot 5$ . The worst accumulation will occur when  $u_0$   $u_1$   $u_{-2}$   $u_{-3}$  are in error in one direction and  $u_{-1}$   $u_2$  in the opposite direction, each by  $\cdot 5$ . In this excessively improbable contingency, the accumulated error will be  $\cdot 5 \times 1\cdot39 \dots$  or just under  $\cdot 7$ , and its effect on the result when stated to the nearest integer will be either 1 or 0.

Newton's formula (1), when a similar account is taken (in other words, when carried to fifth differences), reduces in the same case (the halving of an interval) to

$$\frac{1}{5\frac{1}{2}} (360u_0 + 255u_1 - 95u_{-1} - 32u_2 + 24u_{-2} + 3u_3 - 3u_{-3}),$$

the arithmetical sum of the coefficients being

$$1\frac{6\frac{5}{8}}{28} \text{ or } 1\cdot5078125.$$

When fifth differences are left out of account, it reduces to

$$\frac{1}{12\frac{5}{8}} (90u_0 + 60u_1 - 20u_{-1} - 5u_2 + 3u_{-2}),$$

giving the arithmetical sum  $1\frac{2\frac{5}{6}}{4}$  as in the new formula.

As regards Newton's formula (2), it becomes identical—in the special case of halving an interval—with the new formula, to which it is also closely related in the general case. Any term of (2) containing an even central difference—say of order  $2r$ —together with the term which follows it (containing an odd difference of order  $2r+1$ ) is reducible to the pair of terms which contain differences of order  $2r$  in the new formula.

The following is perhaps the best proof of the new formula.

In dealing with two quantities  $p$  and  $q$  whose sum is constant, the value of  $\Delta f(q)$  is  $f(q+1) - f(q)$  when  $q$  is the independent variable, and  $f(q-1) - f(q)$  when  $p$  is the independent variable, since in the latter case  $\Delta p = 1$  and  $\Delta q = -1$ .

In like manner, if we use another operator  $\delta$  such that  $\delta f(q)$  is  $f(q) - f(q-1)$  when  $q$  is independent variable, we have  $\delta f(q) = f(q) - f(q+1)$  when  $p$  is independent variable.



If we perform the two operations  $\Delta$  and  $\delta$  in succession (in either order), with  $q$  as independent variable, we find

$$\Delta\delta f(q) = f(q+1) + f(q-1) - 2f(q);$$

and if we perform them with  $p$  as independent variable we obtain the same result though the intervening step is different.

When  $f(q)$  is the factorial

$$(q+r)(q+r-1) \dots (q-r+1)(q-r),$$

of  $2r+1$  factors, and  $q$  is taken as independent variable, the operation  $\delta$ , if performed first, substitutes  $2r+1$  for the first factor  $q+r$ , and the operation  $\Delta$  performed on the result substitutes  $2r$  for the last factor  $q-r$ , giving as the final result

$$(2r+1)2r(q+r-1) \dots (q-r+1).$$

Using the symbol  $\phi_r(q)$  to denote  $\frac{(q+r) \dots (q-r)}{1.2 \dots (2r+1)}$ , we have thus

$$\Delta\delta\phi_r(q) = \phi_{r-1}(q); \quad (\Delta\delta)^r\phi_r(q) = \phi_0(q) = q.$$

The expressions

$$\phi_0(q) \text{ or } q, \quad \phi_1(q) \text{ or } \frac{(q+1)q(q-1)}{1.2.3}, \quad \phi_2(q), \quad \&c.,$$

$$\phi_0(p) \text{ or } p, \quad \phi_1(p) \text{ or } \frac{(p+1)p(p-1)}{1.2.3}, \quad \phi_2(p), \quad \&c.,$$

are the coefficients in the new formula; and we are entitled to assume

$$u_p = a_0q + a_2\phi_1(q) + a_4\phi_2(q) + \dots$$

$$+ b_0p + b_2\phi_1(p) + b_4\phi_2(p) + \dots$$

$a_0, b_0, a_2, b_2, \&c.$ , denoting constants which are to be determined; for when  $1-p$  is written for  $q$ , this expression is reducible to a regular series of powers of  $p$  with arbitrary constant coefficients.

Giving  $p$  the value 0,  $q-1$  is also 0, and all the terms vanish except  $a_0q$ , which becomes  $a_0$ . Similarly, when  $p$  is 1 the series reduces to  $b_0$ . Hence

$$a_0 = u_0$$

$$b_0 = u_1$$

Operating by  $\Delta\delta$  we have  $\Delta\delta p = 0$ ,  $\Delta\delta\phi_1(p) = p$ , and the effect on the series (regarded as extending to infinity) is simply to

increase the suffixes of all the  $a$ 's and  $b$ 's by 2. Hence (proceeding as above),

$$\begin{aligned} a_2 &= \Delta \delta u_0 & b_2 &= \Delta \delta u_1, \\ a_4 &= (\Delta \delta)^2 u_0 & b_4 &= (\Delta \delta)^2 u_1, \text{ and so on.} \end{aligned}$$

These values of the coefficients are identical with those assigned to them in the new formula; for the operation  $\Delta \delta$  is equivalent to taking the second central difference of the operand.

*“Data for the Problem of Evolution in Man. V. On the Correlation between Duration of Life and the Number of Offspring.”* By MISS M. BEETON, G. U. YULE, and KARL PEARSON, F.R.S, *University College, London.*

[Paper read before the Royal Society, 14 June 1900, and extracted, with permission, from the Proceedings of the Royal Society.]

1. ACCORDING to the Darwinian theory of evolution the members of a community less fitted to their environment are removed by death. But this process of natural selection would not permanently modify a race, if the members thus removed were able before death to propagate their species in average numbers. It then becomes an important question to ascertain how far duration of life is related to fertility. In the case of many insects death can interfere only with their single chance of offspring; they live or not for their one breeding season only.\* A similar statement holds good with regard to annual and biennial plants. In such cases there might still be a correlation between duration of life and fertility, but it would be of the indirect character, which we actually find in the case of men and women living beyond sixty years of age—a long life means better physique and better physique increased fertility. On the other hand, there is a direct correlation of fertility and duration of life in the case of those animals which generally survive a number of breeding seasons, and it is this correlation which we had at first in view when investigating the influence of duration of life on fertility in man. The discovery of the indirect factor in the correlation referred to above was therefore a point of much

\* Of course longer life may denote greater chance of male or female meeting female or male, but in this case we have not a *graduated* fertility, the individual is or is not once fertile.

interest. For it seems to show that the physique fittest to survive is really the physique which is in itself (and independently of the duration of life) most fecund.

In continuing our study of the inheritance of longevity,\* it occurred to us that it would be possible at the same time as extracting data for duration of life to extract data bearing on the size of the family. Accordingly Miss M. Beeton, in working upon family histories, made records of this additional character. Meanwhile, Mr. G. U. Yule, who had been independently at work on this very point, drew our attention again to the matter in connection with a passage in the *Grammar of Science*.† We agreed to unite our material, and the result is the following joint paper.‡

2. The data dealt with in this paper consist of four series, the first three collected and reduced by Miss M. Beeton, and the fourth series by Mr. G. U. Yule. The sources from which they were extracted are the following:—

#### MOTHERS. LENGTH OF LIFE AND SIZE OF FAMILY.

*Series I.*—Taken from the *Whitney Family, of Connecticut*, a well-known history of an American Quaker family. In order to complete a thousand and more entries some very few additions were made from the *Backhouse Family*, the history of an English north-country Quaker family. This series may be taken to substantially represent American women more or less closely connected with one strain of blood, either by inheritance or by marriage.

As soon as these results were tabled it was noticed that the average age at death of mothers was immensely below the average age at death of Englishwomen. Further, the maximum frequency of deaths which occurs at 35 to 40 was actually greater than the maximum which occurs between 70 to 75! Either then American women of this class die very early, or the women of the Whitney family suffer under some hereditary taint, *e.g.*, phthisis.

*Series II.*—Taken from purely English Quaker records. The data for this series were drawn from a great variety of histories and records most kindly placed at our disposal by Mr. Isaac

\* *Roy. Soc. Proc.*, vol. 65, p. 290.

† Second edition, p. 445.

‡ We have also to very heartily thank Mr. L. N. Filon, M.A., and Mr. K. Tressler for aid in the calculations and preparation of diagrams.

Sharp, Secretary of the Society of Friends, and by the Secretary of the well-known insurance office the Friends' Provident Association, both of whom we desire to cordially thank for their aid. The object here was to avoid the selection which may unconsciously be made when the data are drawn from the records of a single family.\* In these two series, as in the third series, we selected the records of the Society of Friends because—

- (a) They appear to be the most trustworthy and complete of the family histories available.
- (b) The ages at death of the women are given; these are rarely recorded in other genealogical works.
- (c) The artificial limitation of fertility seems to be less probable in a strongly religious community like the Friends than in other classes of the population.

In this series the mean age at death, the modal age, and other constants are quite fairly in accord with what we know of the population at large.

#### FATHERS. LENGTH OF LIFE AND SIZE OF FAMILY.

*Series III.*—The great bulk of the data was extracted from the American Whitney Family. Here the features noted for the women were again observed in the men, but to a much less marked degree. There was a rather high maximum frequency of death at 45,† but not so high as the maximum at 75, and the average age at death was somewhat lower than we find for the general English population. On the whole the series is a very good one.

*Series IV.*—Extracted from Burke's *Landed Gentry*. It has been stated elsewhere‡ that this is a good class for such data. It possesses a higher average fertility than the Peerage, and one in which there is probably comparatively little artificial restriction. Unfortunately it offers no material for the age at death of women.

3. The following are the chief results obtained from the reduction of these series.

\* Of course a "family" history like that of the Whitney family, professing to deal with all the descendants of a single pair, really contains an immense addition through marriage of other strains.

† The existence of a modal value about 45 has already been noted in the resolution of the mortality curve; it is the mode of the middle age mortality component. See *Phil. Trans.*, A, vol. 186, p. 408, and Plate 16.

‡ *Phil. Trans.*, A, vol. 192, p. 257.

I.—*Table of General Results.*

Series	Parent	Mean Age at Death	Mean size of Family	S. D.		Correlation Fertility and Duration of Life	REGRESSION		
				Age at Death	Size of Family		Whole Table	Life 50 Years and under	Life 50 Years and over
I	Mother	53·292	5·269	4·091	3·409	0·4943	0·4119	0·8085	0·2367
II	Mother	61·183	5·811	3·769	3·479	0·2340	0·2159	0·7394	0·0999
III	Father	58·086	5·469	3·213	3·453	0·4764	0·5120	0·8499	0·1684
IV	Father	63·577	5·336	3·037	3·387	0·2010	0·2240	0·5940	0·0720

In this table the unit for the standard deviation of the age at death is 5 years, the unit of the grouping in the accompanying tables. Thus, age at death of mothers 35 gives the frequency of all the group of mothers dying between 32·5 and 37·5. Of course the age at death of certain parents would lie exactly on the boundary of a group, but such exact information is very rarely forthcoming, and when it is in a few cases forthcoming, *i.e.*, the day of both birth and death is given, it is very improbable that the age of death exactly bisects the year. Thus no fractionizing was found necessary in the first three tables. In the *Landed Gentry*, owing to the nature of the record, Mr. Yule found a small amount of fractionizing necessary, and this appears in the Table for Series IV. In the regression coefficients above tabulated 5 years is again the unit, and the coefficient of regression is the constant by which the deviation in the age at death from the mean age at death, measured in 5-year units, must be multiplied in order to obtain the probable deviation of the family from the mean family.

II.—*Table of Regression Formulæ or Curves.*

$y$  = Size of Family,       $x$  = Duration of Life.

*Series I. American Mothers.*

- (a) For all lives. Straight line:  
 $y = 0·8796 + 0·082,372x$
- (b) For lives of 50 years and under. Straight line:  
 $y = -1·9334 + 0·161,706x$
- (c) For lives of 50 years and over. Straight line:  
 $y = 3·3740 + 0·047,346x$
- (d) For all lives. Cubical parabola. Origin of  $x$  at 55 years and unit = 5 years:  
 $y = 6·0208 + 0·328,474x - 0·035,056x^2 + 0·003,000x^3$
- } Origin of  $x$   
at birth and  
unit of  $x$  one  
year.



*Series II. English Mothers.*

- (a) For all lives. Straight line :  
 $y = 3.1681 + 0.043,188x$
- (b) For lives of 50 years and under. Straight line :  
 $y = -0.9009 + 0.147,880x$
- (c) For lives of 50 years and over. Straight line :  
 $y = 4.85198 + 0.019,973x$
- (d) For all lives. Cubical parabola. Origin of  $x$  at 57.5 years and unit = 5 years :  
 $y = 6.4092 + 0.079,120x - 0.052,719x^2 + 0.005,717x^3.$

Origin of  $x$   
at birth and  
unit of  $x$  one  
year.

*Series III. American Fathers.*

- (a) For all lives. Straight line :  
 $y = 0.4799 + 0.102,410x$
- (b) For lives of 50 years and under. Straight line :  
 $y = -2.7429 + 0.169,978x$
- (c) For lives of 50 years and over. Straight line :  
 $y = 4.0005 + 0.033,670x$
- (d) For all lives. Cubical parabola. Origin of  $x$  at 55 years and unit = 5 years :  
 $y = 5.8187 + 0.363,122x - 0.047,438x^2 + 0.003,035x^3.$

Origin of  $x$   
at birth and  
unit of  $x$  one  
year.

*Series IV. English Fathers.*

- (a) For all lives. Straight line :  
 $y = 2.4877 + 0.044,800x$
- (b) For lives of 50 years and under. Straight line :  
 $y = -1.0061 + 0.118,800x$
- (c) For lives of 50 years and over. Straight line :  
 $y = 4.6717 + 0.014,400x$
- (d) For all lives. Cubical parabola. Origin of  $x$  at 60 years and unit = 5 years :  
 $y = 5.5075 + 0.153,403x - 0.041,940x^2 + 0.003,636x^3.$

Origin of  $x$   
at birth and  
unit of  $x$  one  
year.

The constants of the straight lines for all these series have been found at once by fitting the best straight line to the observations, *i.e.*, by using the regression formula—

$$y - \text{mean } y = \text{coefficient of regression} \left( \text{or } r \frac{\sigma_y}{\sigma_x} \right) \times (x - \text{mean } x).*$$

The cubical parabolas have been fitted by the method of moments.†

\* See Yule, *Roy. Soc. Proc.*, vol. 60, p. 477.

† I have shown in a memoir not yet published (a) how to fit all types of curves, but particular parabolas of any order, by the method of moments; and (b) that such method gives results practically of the same order of exactness as those given by the method of least squares.—K.P.

The whole of this system of formulæ has been plotted, and is exhibited graphically in the accompanying diagrams. These diagrams suffice to give the entire graphical solution of this problem to an exactness sufficient for all practical purposes. A careful examination of these diagrams will enable the reader to follow our general conclusions even more clearly than inspection of the algebraic formula.

4. *General Conclusions.*—(i.) The regression straight line for all lives, *aa*, does not give a satisfactory picture of the relation between age at death of a parent and the average number of offspring. We see at once that it is too steep at the beginning and not steep enough at the end of life. Accordingly, starting from 50 years as the sensible limit to woman's child-bearing period, the mothers were broken up into two groups, and the regression lines calculated separately for lives of 50 years and under, and for lives of 50 years and over. In this way quite a reasonable fit was obtained to the observations. For convenience, the age of 50 was also taken as a dividing age for fathers. In all four cases the regression line *cc* for parents living beyond 50 years shows a quite sensible deviation from the perpendicular, or *fertility is correlated with longevity even after the fecund period is passed.*

If we take American mothers, there is no doubt of this increasing fertility even up to 90 years of age. With English mothers it is less marked, but appears to be quite true up to 75 years. Beyond 75 there appears to be a slight decrease. Turning to the two series for fathers, we see that we might possibly have better taken 60 than 50 as a dividing age, for the general trend of the observations is much the same up to 60 years. After this there is still a sensible trend in the American results, so that aged fathers are again the most fertile. With the English fathers this relation is, as is the case with English mothers, far less marked, although it is sensible if we take fathers over 50 years.

Thus I think we might sum up: That the peculiar physique in both men and women which leads to longevity is also associated with greater fecundity. Of two women who both live beyond 50 years, the longer lived is likely to have had before 50 the larger family. The association is, however, much greater for American than English parents, although the American parents dealt with are, in the great majority of cases, of Anglo-Saxon race. Climate, mode of life, generally selection and environment, seem to be differentiating in this respect the English and the Anglo-American. The English Friends, we should suppose, would be a

class very comparable with the American Friends, yet their average life is longer, their fertility greater, and there is less association between longevity and fecundity. In both cases our algebraical formulæ show that American men and women are more alike, and Englishmen and women are more alike than the women to the women or the men to the men of the two races. This is the more remarkable as the English Friends as a class are by no means identical with the Landed Gentry.

(ii.) In order to represent the *continuous* change in the regression, which cannot be done by two straight lines, which only enable us to distinguish the fecund and non-fecund periods of life, the statistics were fitted with cubical parabolas. The regression line at any age in life may then be looked upon as the tangent to the cubical parabola at that age. An inspection of Diagrams 5 to 8 shows what an excellent expression such parabolas are for these statistics.

For American mothers and fathers we see  $dy/dx$  consistently positive throughout life, and we have a most excellent graphical demonstration of the physical characters which tend to longevity being also associated with fecundity. In the English fathers the same feature appears in a much less marked degree; there is a point of inflexion in the curve, although  $dy/dx$  remains positive. Up to about 75, however, the number of offspring continues to increase with the duration of life, and when we break off at 95, the curve has got a renewed outward trend. With English mothers, however, the curve has got a small but sensible trend inwards in old age. For fifteen years after the climateric increased life connotes larger family, *i.e.*, shows fecundity associated with the physique peculiar to longevity, but beyond 65, as judged by the parabola, longevity is slightly unfavourable to fecundity.\*

The following are the values of the regression coefficients obtained by differentiating the cubical parabola and referring to birth as origin and a year as unit :—

\* It has been suggested that this is due to the nature of the record, there being a tendency to enter only the children who survive their parents. Thus the longer the latter live the fewer would be the offspring entered. In other words, we should be under-estimating the correlation between fertility and longevity. But the Quaker birth-records include all children, and their system is uniform. There does not appear any reason on this ground for English and American returns differing so sensibly.

TABLE III.—*Regression Coefficients showing change with Duration of Life z.*

Series	Old Method, line aa	Cubical Parabola
I	0.0824	$0.437,741 - 0.010,7240z + 0.000,0720z^2$
II	0.0432	$0.711,949 - 0.019,9955z + 0.000,1372z^3$
III	0.1024	$0.501,693 - 0.011,8074z + 0.000,0728z^2$
IV	0.0448	$0.546,143 - 0.013,8269z + 0.000,0873z^2$

By simply substituting the number of years of life  $z$ , we can find the value of the regression at any age.

5. *Illustrations of these results.*—(i.) What is the probable family of an English mother dying at 40?

(a) gives 4.90, (b) 5.01, and (d) 5.24, all of which might equally well have been read off on the diagrams. The actually observed number is considerably in excess of all these, *i.e.*, 6.23. In fact, if an English mother lives to 40 years she will, on the average, have very nearly completed her family. For an American woman (a) gives 4.17, (b) 4.53, and (d) 4.64. But if she lives another ten or twenty years she will probably have a family of 5.20 or even 5.65.

(ii.) Compare the strength of the relationship between duration of life and size of family for American fathers dying at 40 and 70 respectively.

We find the slope of the cubical parabola at the points corresponding to 40 and 70 years to be 0.1459 and 0.0249 respectively. The mean regression for the whole of life is 0.1024; for the first fifty years 0.1700, and for the last fifty 0.0337 (see Table I, and reduce to year as unit). It thus appears that the influence of mere number of years as compared with the physique which tends to longevity has an effect on fertility of about 5 or 6 to 1.

(iii.) Weismann has suggested that it may be an advantage to a species that its duration of life should be shortened. This is not, *à priori*, confirmed for the case of man in the American series: the longer the parents live the greater the number of their offspring. But if we can lay any stress on the bend-in for the English mothers, and on the similar but less marked tendency for the English fathers, we might argue that reproductive selection was possibly in England working against extreme longevity,

although favouring parents living till 65 or 70. Indeed those who rush rapidly to brilliant but not over-stable conclusions might emphasize Weismann's views by showing how in an old community with much greater pressure on the material resources, there is a tendency to reduce the fertility of the long-lived parents; while in a new community, with plenty of food and occupation for all, the longest-lived parents are the most fertile! However, all that we can safely say is that there is a marked difference between English and American parents, and that this distinguishing characteristic is almost equally visible if we take opposite sexes of such diverse classes as English Friends and English country gentlemen. We would leave to further investigations its true interpretations.

6. Admitting a substantial correlation between length of life and fertility, it is of great interest to investigate what effect, other things being equal,\* reproductive selection would have in modifying the duration of life.

The following table gives the mean length of life of parents taken singly and of parents weighted with their offspring:—

TABLE IV.—*Mean Duration of Life of Parents in Years.*

Series	Unweighted Parents	Weighted Parents	Progression
I	53.292	59.920	6.628
II	61.183	63.839	2.656
III	58.086	63.082	4.996
IV	63.577	65.510	1.930

Now these are substantial differences even in the case of the English parents (II and IV), but they are very large differences in the case of the American parents (I and III). If we suppose no assortative mating on the basis of characters tending towards longevity, then it is easy to obtain a rough approximation to the effect of reproductive selection in modifying the duration of life. It has been shown† that if there be no assortative mating the average deviation,  $h_1$ , of an array of offspring from the mean of the general population of offspring due to parents deviating  $h_2$

\* Omitting, for example, the effect of natural selection as evidenced possibly in a greater death-rate in large families, &c.

† *Phil. Trans.*, vol. 187, p. 288.



and  $h_3$  from the means of the general populations of parents is given by

$$h_1 = r_{12} \frac{\sigma_1}{\sigma_2} h_2 + r_{13} \frac{\sigma_1}{\sigma_3} h_3,$$

where  $r_{12}$  and  $r_{13}$  are coefficients of parental inheritance, and  $\sigma_1$ ,  $\sigma_2$ ,  $\sigma_3$ , the standard deviations in offspring and parents for the character in question. When that character is longevity our data are not yet complete, but two of us have shown that the value of  $r_{12}\sigma_1/\sigma_2$  for father and son, *i.e.*, the regression coefficient for inheritance of duration of life, is about 0.1682,\* if the sons die having lived at least 21 years. We have not yet completed our data for the inheritance of the duration of life in the case (i) of minors, or (ii) in the case of the female line, although we have nearly reached the requisite amount of material. Hence the following statements must be taken as tentative and suggestive only. We will assume 0.1682 to be the regression coefficient for both sexes, and *for all ages of the offspring, minors or adults*. In this case if  $m_1$  be the mean of the unweighted, and  $m_2$  of the weighted fathers,  $m_1'$  of the unweighted and  $m_2'$  of the weighted mothers, we should expect an increased duration of life in the offspring due to reproductive selection of

$$\begin{aligned} h_1 &= 0.1682 (m_2 - m_1) + 0.1682 (m_2' - m_1') \\ &= 0.1682 (6.628 + 4.496), \text{ for the Americans} \\ &= 1.9551 \\ &= 0.1682 (2.656 + 1.900), \text{ for the English} \\ &= 0.7714 \end{aligned}$$

Thus the increased duration of life would be about 2 years per generation from the American data, and about 9 to 9.5 months per generation from the English data.

The result for the American series shows us how an especially low expectation of life, due possibly in this case to some family character,† will be rapidly raised by reproductive selection, if there be no opposing factor of evolution. The English results on

\* *Roy. Soc. Proc.*, vol. 65, p. 297. The Landed Gentry would appear to be closer than the Peerage to our present material.

† It is by no means certain that this is the true view of the case. We have seen that the American women have their maximum mortality in early middle-life, and only a secondary maximum at 70. The maximum mortality of the table prepared by J. P., F.R.S., for the years 1728-57 (*A Collection of the Yearly Bills of Mortality from 1657 to 1758 inclusive*, London, 1759) occurs about 41 years, and there is no evidence of a maximum at 70 at all. Thus the American data appear to resemble London data of two centuries back.

the other hand show us a small but sensible tendency in reproductive selection to prolong the duration of life. Allowing three generations to a century we might expect the duration of life to be raised about 2 years in a century by this factor of evolution.

In making this statement we are supposing that parents are not a short-lived selection out of the general adult population. There seems no reason why they should be, and we have some statistics to show they are not. Thus, for the Peerage and Landed Gentry, we have shown that for fathers and sons living 20 or 25 years and upwards, the age at death of the father is substantially greater than that of the son.\* Further, from data for the Society of Friends, Miss Beeton has found the average age at death of women in general to be 59·831, and the average age of mothers at death to be 59·793, sensibly the same. In the table for 1871 to 1880 given by the Registrar-General, the expectation of life of women in general at 20 years of age is given as 41·66 years, or the average duration of life is 61·66 years. This is only very slightly greater than our average† for English mothers above, *i.e.*, 61·183, and substantially less than our average for mothers weighted with their offspring, *i.e.*, 63·082 years. Again, the general population of males of 20 had (1871–80 returns) an average life of 64·48 years, which is not comparable with our Landed Gentry's sons surviving 20 with an average life of 60·915 years, but with that of their fathers, *i.e.*, 65·96 years. We do not think, therefore, that parentage, in particular maternity, corresponds to any shortening in the expectation of life. Thus, reproductive selection appears to indicate a real increase of the expectation of life. Such an increased expectation of life is usually considered to have come into existence during our century owing to better sanitary conditions, greater care of the sick and invalided, &c., &c. Its exact estimation is a matter of some difficulty. Thus, F. G. P. Neison,‡ working on the Registrar-General's returns before 1841, gives (Table D, p. 8) expectations of life from 10 years onwards. For males of 20 and 25, his mean durations of life are 60·69 and 62·35; for females of 20 and 25, 61·60 and 63·36 respectively. These are not substantially less

\* *Roy. Soc. Proc.*, vol. 65, p. 297.

† The average age at death of mothers must in our case closely give the expectation of life of women of 20, for there are few marriages below 20, and we have in our tables included all cases of sterile unions.

‡ *Contributions to Vital Statistics*, London, 1846.

than the Registrar-General's returns for 1881 to 1890, which gives males 60·27 and 61·28, females 62·42 and 63·50 respectively. In fact, the males show reduction. If we stick to the Registrar-General's returns as given for three different periods, and presumably more comparable with each other than with Neison's work, we have the following results:—

*Expectation of Life.*

Age	1838-54		1871-80		1881-90	
	Males	Females	Males	Females	Males	Females
0	39·91	41·85	41·35	44·62	43·66	47·18
20	39·48	40·29	39·40	41·66	40·27	42·42
25	36·12	37·04	35·68	37·98	36·28	38·50

Here there is an increased expectation at birth for males, but very small increases between the first and last periods at 20 and 25. For females there is an immense increase at birth and sensible increase in the other cases. Possibly a good deal of this may be due to more exact returns for the ages of women being now obtainable.

If we take the earliest Table of the Probabilities of Life, that deduced by J. P., F.R.S., for the bills of mortality in London for 1728 to 1757, and printed in the work cited on p. 467, we find the number of deaths of 1,000 persons born given for each year of life, male and female being combined. According to the Registrar-General's returns for 1881-90, of 1000 persons born, 728 survive to 20 and 709 to 25, but from J. P.'s table only 485 survive to 20 and 448 to 25. This tremendous mortality of infancy and youth was probably largely a *selective* death rate. We find, accordingly, the expectation of life at birth to be only 25·59 years; at 20, however, to be 49·56 years; and at 25 to be 51·30 years.\* These results are for London, not for England in general, but making all possible allowances for the difference between city and country, they suggest a most stringent selection, and an increased expectation of life at birth of anything like 25 years in less than two centuries could not be achieved even at the American rate of two years per generation. Nor is it possible that the whole of the

\* We do not know how J. P.'s table was deduced, but we got the above results by averaging the years lived by those surviving at any age out of the 1,000 born.

increase in the Registrar-General's returns for expectation of life at birth for the periods 1838-54 and 1881-90—an increase of somewhere about four or five years—could be due to reproductive selection, unless we suppose the correlation between age at death of minors and of their parents to be considerably greater than 0.1682. On the other hand, if we confined our attention to adults of 20 to 25 of both sexes, we have, roughly, an increase of about a year in the expectation of life, and this result with nine months per generation could easily have been reached within the two-generation period in question. Generally we may conclude that the data are not very suitable for real purposes of comparison, but that there is nothing in them opposed to the suggestion that a sensible part of the increased duration of life of this century may be due to the inheritance of longevity and the correlation of longevity with fertility. Further determination of the inheritance of duration of life in the case of minors may help throw additional light on the matter.

7. The following method of illustrating the influence of longevity on fertility may serve to impress the matter on the reader:—

In Series I the longer-lived moiety of the mothers produce 64.0 per-cent of the children, and the shorter-lived moiety 36.0 per-cent.

In Series III the longer-lived moiety of the fathers produce 61.1 per-cent of the children, and the shorter-lived moiety 38.9 per-cent.

In Series II the longer-lived moiety of the mothers produce 55.2 per-cent of the children, and the shorter-lived moiety 44.8 per-cent.

In Series IV the longer-lived moiety of the fathers produce 53.5 per-cent of the children, and the shorter-lived moiety 46.5 per-cent.

Thus, while the results are all very sensible, those for the American parents are markedly so. In both American and English statistics the influence of longevity on the fertility of the mother is greater than its influence on the father.

8. *Concluding Remarks.*—A somewhat widespread view of evolution stops at the survival of the fitter without discussing the mode whereby the less fit leave no, or fewer, offspring than the fit. Of course, if the unfit are exterminated before adult life, there is no chance of their reproducing themselves. It has been shown in the second paper of this series that a selective death-rate does not exist for adults, so that the whole work of selection

does not take place before the reproductive stage is reached. But Miss Beeton's data for the correlation of duration of life in the case of brethren dying as minors seem to show that the selective death-rate for children is rather less than greater than its value for adults.\* Hence, for the reduction or extermination of stock unsuited to its environment, we should have to look largely to selection in the adult state. In the present paper we have made what we believe to be the first quantitative determination of how a selective mortality reduces the numbers of the offspring of the less fit relatively to the fitter. In the case of life under wild conditions, the correlation between fertility and power of surviving would probably be far greater. But for such life it is almost impossible to get statistics of this nature; we are thrown back upon measuring the effect in man, and thus obtaining what may well be considered as a minimum value of the influence under discussion.

In the course of our investigations we have seen that the relationship between fertility and duration of life does not cease with the fecund period. We thus reach the important result that characters which build up a constitution fittest to survive are also characters which encourage its fertility. This result is of great value for the standpoint of the differentiation of type, where it is absolutely necessary that the fittest to survive should also be the most fertile.† On the other hand, we note that duration of life is a character capable of modification by reproductive selection, and we suggest that a considerable part of the increased expectation of life observed in recent years may be due to this cause. In the case of the American statistics, we see at once how it can replace a remarkably short-lived stock by a longer-lived stock, the bulk of the offspring coming from the longer-lived members.

\* The matter is still under investigation, so that this conclusion is stated subject to modification. Of course, the selective death-rate among children may largely remove those not weak from *inherited* constitution, but by physical or physiological accident. These our method of investigation would throw into the non-selective death-rate.

† *The Grammar of Science*, second edition, pp. 448-9.



TABLE V.—*Mothers and Offspring. Series I. Age of Mother at Death.*

Number of Offspring.	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	Totals
	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	3 47 20 7 8 1 1 ... ... ... ... ... ... ... ... ... ... ...	1 25 26 21 15 6 4 1 ... ... ... ... ... ... ... ... ... ...	1 9 13 21 15 14 12 18 3 2 1 ... ... ... ... ... ... ... ...	3 6 8 15 15 10 7 5 8 7 4 0 0 0 0 0 1 ... ...	5 5 10 12 9 10 8 8 6 6 4 4 4 0 0 0 0 0 ... ...	2 2 8 9 8 5 3 7 8 3 4 0 2 1 0 0 1 0 0 1	0 2 6 5 5 4 6 8 5 6 10 7 3 3 0 1 0 0 0 0 0 0	0 4 5 5 6 11 6 10 7 3 3 1 2 3 1 1 0 0 0 0	3 4 8 8 6 5 7 5 5 10 6 3 2 2 2 2 2 2 2 0	3 3 7 5 6 12 5 6 9 6 13 6 5 3 4 1 3 0 0 0 0 0 0	1 1 0 13 4 9 11 5 5 6 9 9 8 5 3 4 0 0 0 0 0 0	2 2 5 8 7 11 7 2 10 2 7 8 1 4 1 1 0 0 0 0	... 2 1 1 1 1 2 3 2 2 6 2 2 1 1 0 0 0 0	... ... 1 0 0 ... 1 0 0 ... ... ... ... ... ... ... ...	24 130 122 134 111 106 85 91 81 77 58 23 24 15 6 2 2 2 2 2		
Mothers, Totals	29	87	99	109	90	87	64	54	69	73	83	77	78	59	26	7	4	1,095
Offspring, Totals	36	151	261	478	450	437	370	331	436	447	547	590	547	398	212	50	35	5,776

TABLE VI.—*Mothers and Offspring. Series II. Age of Mother at Death.*

Number of Offspring.	Totals.																	
	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
0	0	0	0	0	0	0	2	0	2	1	2	0	2	2	0	1	...	...
1	5	19	17	5	5	4	4	2	7	6	6	7	7	5	4	0	...	...
2	...	10	12	5	1	7	7	4	8	8	11	6	5	3	5	3	...	...
3	...	4	7	7	4	1	5	3	10	12	8	7	9	4	3	0	...	...
4	...	1	7	12	7	4	9	7	7	8	9	13	9	8	4	1	...	...
5	...	0	3	11	18	10	6	15	5	15	12	13	12	11	3	0	...	...
6	...	1	5	8	5	5	7	4	4	9	8	13	9	9	6	0	...	1
7	...	...	2	8	5	5	2	5	6	9	13	12	11	10	5	1	1	...
8	...	...	1	5	2	14	0	1	10	8	6	8	8	10	4	1	...	...
9	...	...	3	0	8	3	2	9	3	7	10	13	4	9	5	0	...	...
10	...	...	...	2	3	3	2	5	3	8	10	10	6	4	1	0	...	...
11	...	...	...	...	4	1	2	2	4	5	5	4	3	3	1	0	...	...
12	...	...	...	...	1	1	1	4	2	4	3	5	3	2	0	0	...	...
13	...	...	...	...	1	2	0	1	1	2	3	1	3	1	1	0	...	...
14	...	...	...	...	0	0	1	0	1	3	4	1	1	0	0	0	...	...
15	...	...	...	...	0	0	0	0	1	0	1	0	1	0	1	1	...	...
16	...	...	...	...	1	0	0	0	0	0	0	0	1	0	1	...	...	...
17	...	...	...	...	...	...	...	0	0	0	0	2	...	...	...	...	...	...
18	...	...	...	...	...	...	...	1	0	0	0	0	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...
Mothers, Totals	5	35	57	63	65	62	50	63	74	105	111	117	94	81	44	8	1	1,036
Offspring, Totals	5	61	184	303	405	382	241	421	419	660	726	804	584	505	267	40	7	6,020

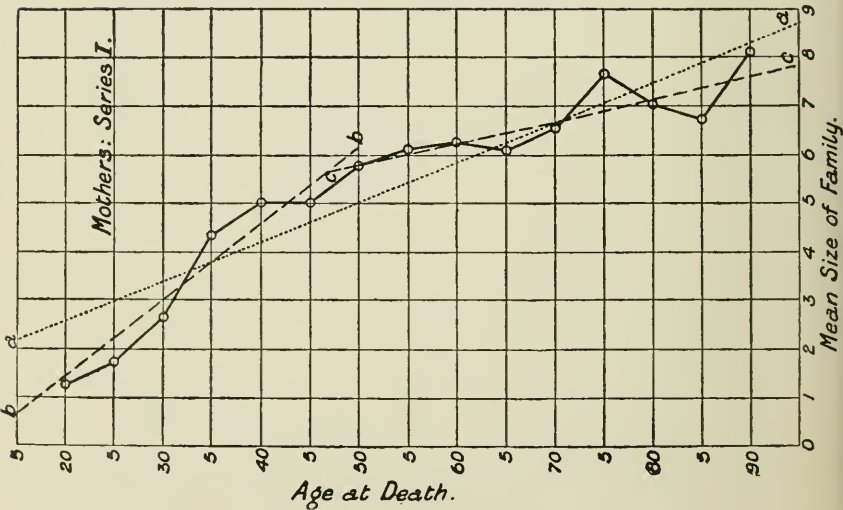
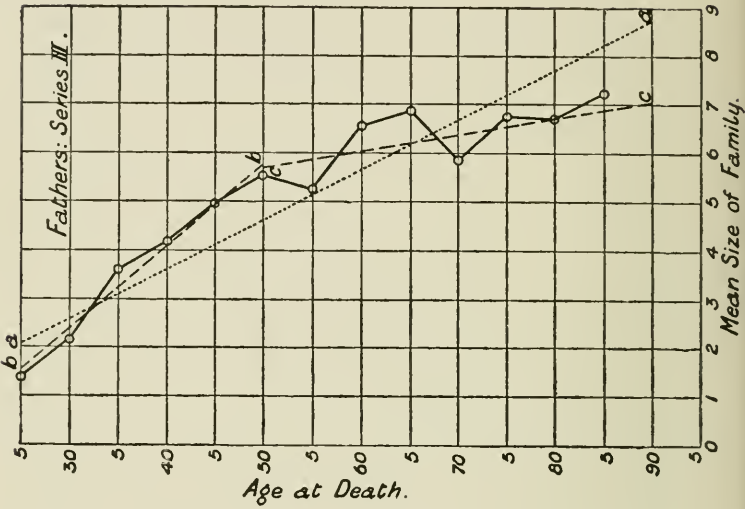
TABLE VII.—*Fathers and Offspring. Series III. Age of Father at Death.*

Number of Offspring.	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	Totals.
	0	7	4	1	0	4	3	4	2	2	4	4	3	0	0	0	0	38
1	1	24	15	5	11	13	4	8	3	5	4	0	1	1	2	0	0	97
2	1	9	24	16	10	11	7	8	10	6	6	8	6	2	0	0	0	124
3	...	3	12	14	12	7	7	8	7	6	10	9	7	5	0	2	1	110
4	...	1	4	13	14	8	15	11	4	8	9	11	4	6	1	0	1	110
5	...	1	4	12	9	11	8	12	11	11	18	10	10	2	1	1	0	121
6	...	...	...	5	10	6	6	7	10	6	8	10	10	8	1	0	1	88
7	...	...	...	2	6	9	3	7	10	11	8	8	9	9	1	1	0	84
8	...	...	...	1	2	6	7	5	10	8	9	8	12	11	2	2	0	83
9	...	...	...	1	1	5	4	7	6	10	13	13	5	5	1	1	0	72
10	...	...	...	...	1	4	2	2	7	8	6	7	6	4	1	2	1	61
11	...	...	...	...	1	1	2	2	8	5	0	7	4	5	1	1	0	40
12	...	...	...	...	...	1	3	2	2	4	1	4	5	2	0	1	1	26
13	...	...	...	...	...	...	1	0	1	3	1	3	2	3	1	0	0	15
14	...	...	...	...	...	...	...	1	1	1	1	3	0	0	0	1	1	7
15	...	...	...	...	...	...	...	...	2	0	0	0	0	0	0	1	0	4
16	...	...	...	...	...	...	...	...	...	2	0	0	1	0	0	0	0	3
17	...	...	...	...	...	...	...	...	...	...	1	0	0	0	0	0	0	1
Fathers, totals...	2	45	63	70	78	91	76	87	94	96	99	105	85	63	12	12	6	1084
Offspring, totals	3	60	135	252	325	450	419	458	618	657	581	710	570	456	83	101	50	5928

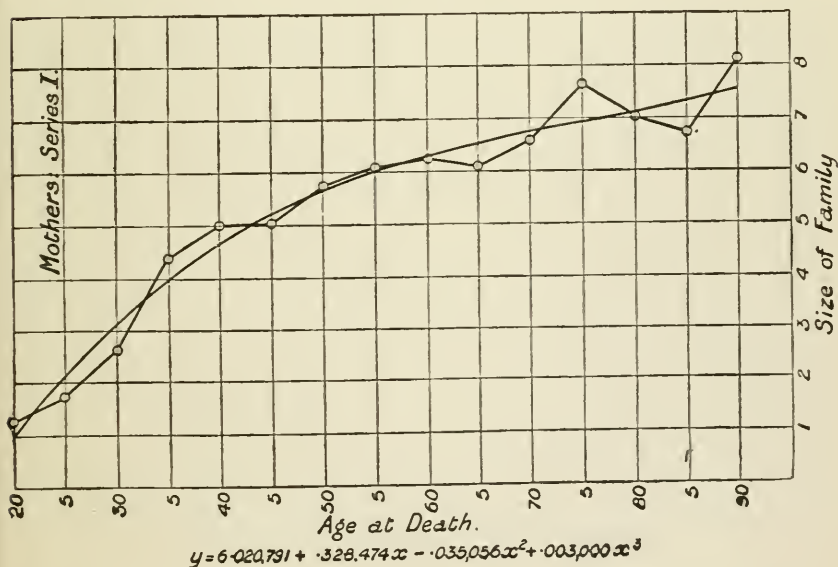
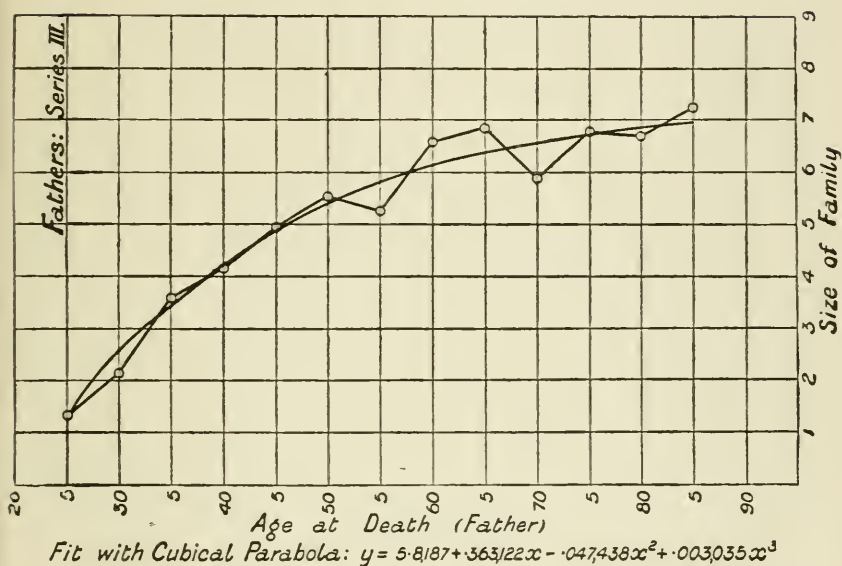
TABLE VIII.—Fathers and Offspring. Series IV. Age of Father at Death.

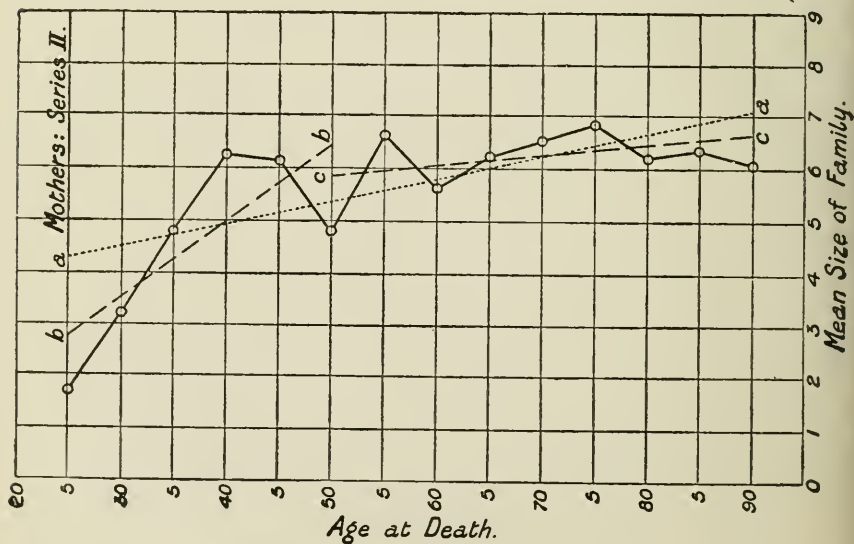
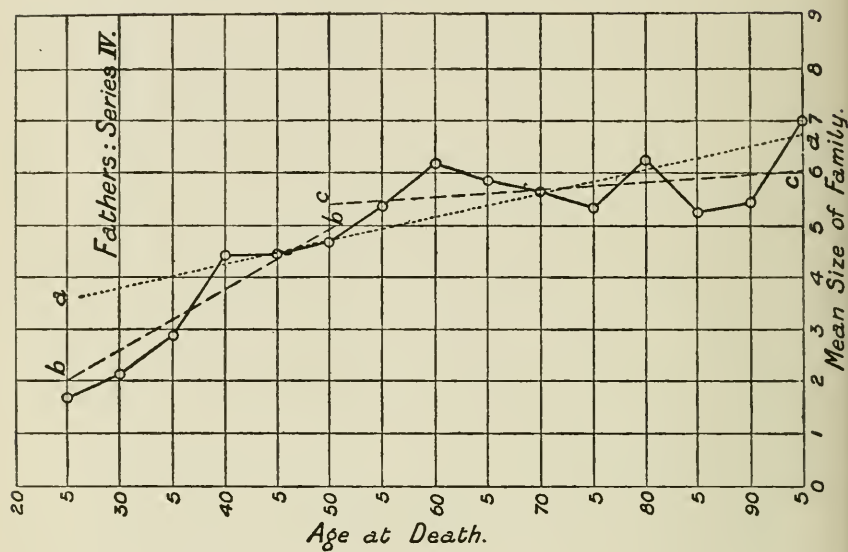
	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	Totals.
Number of Offspring.	2	5	6	2	10	11	7	4	6	6	7	7	6	2	1	0	0	82
	2	3	5	1	4	4	3	8	6	5	8	1	1	2	0	0	0	53
	1	4	4	5	5	5	4	5	3	11	9	6	4	0	0	0	0	67
	1	3	4	7	6	7	10	9	14	10	11	13	6	3	0	0	0	109
	0	2	5	8	8	10	8	15	12	12	19	18	5	4	0	0	0	121
	1	2	3	6	9	15	10	17	16	18	16	7	9	1	0	0	0	131
	...	1	1	6	9	6	11	10	14	13	19	5	8	4	0	0	1	109
	...	...	1	1	3	4	4	10	12	13	6	13	1	4	0	0	...	72
	...	...	1	3	6	5	3	11	14	15	8	13	2	4	0	0	...	85
	...	...	1	0	1	4	8	6	7	3	7	5	5	1	1	0	...	50
	...	...	...	0	4	4	6	7	7	3	7	12	4	1	0	0	...	49
	...	...	...	2	0	1	4	3	2	3	1	6	0	0	0	0	...	22
	...	...	...	...	0	2	1	5	4	2	5	0	1	0	1	0	...	23
	...	...	...	...	0	0	0	2	0	2	2	4	0	0	0	0	...	10
	...	...	...	...	1	0	0	1	3	1	0	1	1	0	0	1	...	9
	...	...	...	...	...	...	...	0	0	0	0	2	0	...	...	...	3	
	...	...	...	...	...	...	...	1	1	0	0	...	...	...	...	...	2	
	...	...	...	...	...	...	...	1	1	0	0	...	...	...	...	...	2	
	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	0	
	...	...	...	...	...	...	...	...	...	...	0	...	...	...	...	...	0	
	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1
Fathers, totals...	7	20.5	35	41.5	65	76	81.5	108.5	121	122	122	114	54	27	3	1	1	1000
Offspring, totals	12	45	102	184	290	357	439.5	672.5	712	687	649	713.5	284.5	147	21	14	6	5336

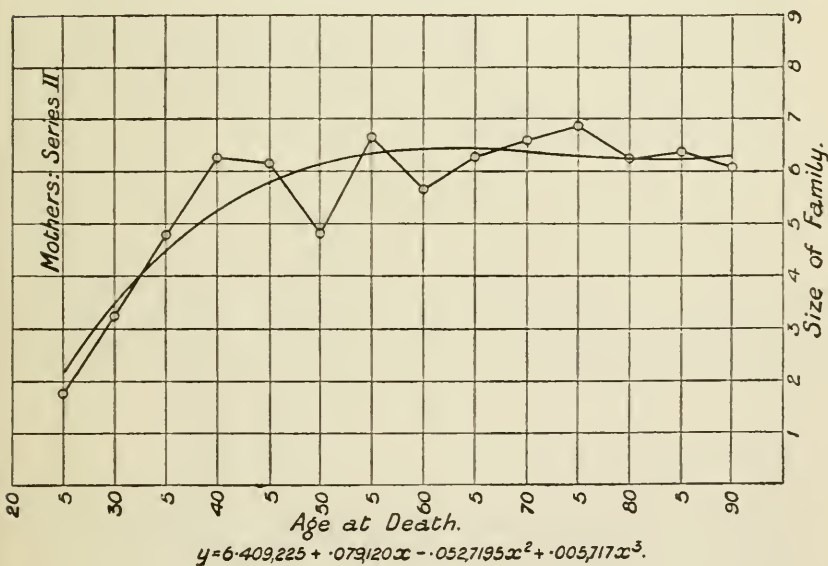
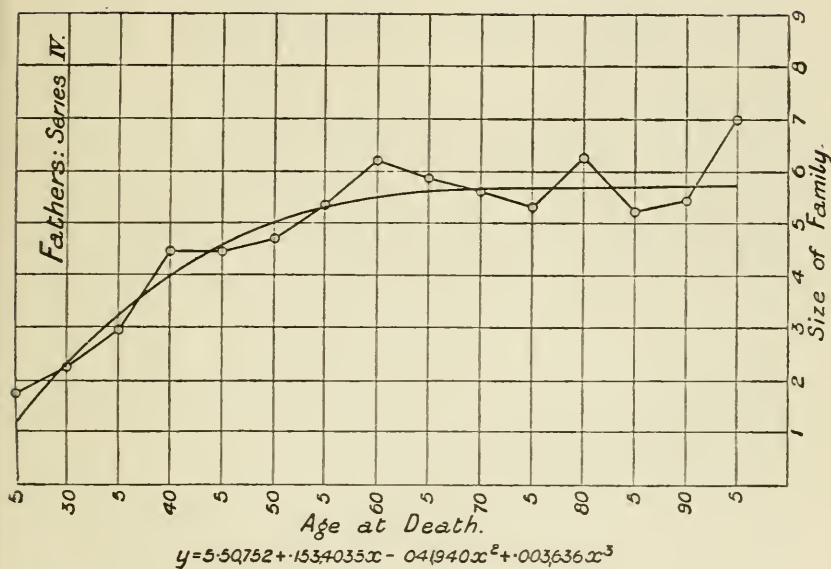
American Parents. Regression Straight Lines.





*American Parents. Regression Cubical Parabola.*

*English Parents. Regression Straight Lines.*

*English Parents. Regression Cubical Parabola.*

# ACTUARIAL NOTE.

*On the Solution of a General Problem relating to Contingent Assurances.* By GEORGE J. LIDSTONE, F.I.A.

IN Chapter XIII of the *Institute of Actuaries' Text-Book*, it is pointed out that "all the contingent assurances in which "only one order of survivorship is involved may be expressed in "terms of assurances which determine on the first death", and that "by this means the numerical calculation of the benefits is much facilitated." The object of this note is to express, in the form referred to, the assurance values  $\bar{A}_{X:Y}^1$  and  $A_{X:Y}^1$ , where X represents a status of the form  $\frac{r}{abc \dots (n)}$ , and Y a status of the form  $\frac{s}{xyz \dots (n)}$  or  $\frac{[s]}{xyz \dots (n)}$ ; and further to indicate how even greater generality may be obtained.

Taking first the continuous assurance, we have

$$\bar{A}_{X:Y}^1 = - \int_0^\infty v^t \cdot {}_t p_Y \cdot \frac{d {}_t p_X}{dt} \cdot dt.$$

First suppose Y to be of the form  $\frac{s}{xyz \dots (n)}$ . Then  ${}_t p_Y$  may be expressed in terms of simple joint-life probabilities, as shown in Chapter II of the *Text-Book*; and if  $Z^l$  denote the sum of the various joint-life probabilities for all possible combinations of  $l$  lives out of the  $n$  lives  $xyz \dots$ , we shall have

$${}_t p_Y = \frac{Z^s}{(1+Z)^s} = Z^s - sZ^{s+1} + \dots \pm \frac{|l-1|}{s-1} \frac{|l-s|}{l-s} Z^l \mp \dots \quad (1)$$

We may express  ${}_t p_X$  in a similar form, and since the differential coefficient of a sum is equal to the total of the differential coefficients of the several functions included in that sum, we may write

$$\frac{d}{dt} {}_t p_X = \frac{\Omega^r}{(1+\Omega)^r} = \Omega^r - r\Omega^{r+1} + \dots \pm \frac{|k-1|}{r-1} \frac{|k-r|}{k-r} \Omega^k \mp \dots \quad (2)$$

where  $\Omega^k$  denotes the sum of the various values of  $\frac{d}{dt} {}_t p_{abc \dots (k)}$  for all possible combinations of  $k$  lives out of the  $m$  lives  $abc \dots$ .

Hence, restoring the factor  $v^t$ , we shall have

$$-v^t \cdot {}_t p_Y \cdot \frac{d}{dt} {}_t p_X = -v^t \left[ \frac{Z^s}{(1+Z)^s} \cdot \frac{\Omega^r}{(1+\Omega)^r} \right] \quad \dots \quad (3)$$

where the meaning to be attached to the expression in brackets is as follows:—

- (a) The expression is to be expanded in a series of terms of the form  $\Omega^k Z^l$ , all terms in which  $k$  is  $> m$ , or  $l > n$ , being rejected. The coefficient of the general term  $\Omega^k Z^l$  will evidently be the product of the coefficient of  $\Omega^k$  in (2) and  $Z^l$  in (1); it will therefore

$$\text{be } \frac{|k-1|}{|r-1| |k-r|} \cdot \frac{|l-1|}{|s-1| |l-s|} = C_{k, l}, \text{ say.}$$

- (b) Each term of the series is to be further expanded by giving  $\Omega^k$  and  $Z^l$  their values in terms of joint-life probabilities, and forming the algebraical product. Thus, for example,  $\Omega^3 Z^2$  will represent

$$\left( \frac{d}{dt} {}_t p_{abc} + \frac{d}{dt} {}_t p_{abd} + \dots \right) ({}_t p_{xy} + {}_t p_{xz} + \dots).$$

The secondary expansion referred to in (b) will evidently give rise to all possible terms of the form  ${}_t p_{xyz \dots (l)} \times \frac{d}{dt} {}_t p_{abc \dots (k)}$  each multiplied by its proper coefficient,  $C_{k, l}$ . Now since

$$-\int_0^\infty v^t \cdot {}_t p_{xyz \dots (l)} \frac{d}{dt} {}_t p_{abc \dots (k)} \cdot dt = \bar{A}_{\substack{abc \dots (k) : xyz \dots (l)}} \frac{1}{\dots}$$

it follows that in the integration of expression (3) each term of the type  $-v^t {}_t p_{xyz \dots (l)} \times \frac{d}{dt} {}_t p_{abc \dots (k)}$  will give rise to a term of the type  $-\bar{A}_{\substack{abc \dots (l) : xyz \dots (l)}} \frac{1}{\dots}$ . Let  $W_{k, l}$  represent the sum of all possible terms of this type, the  $k$  lives which form the *failing* status being selected from  $abc \dots$ , and the  $l$  *counter* lives from  $xyz \dots$ . Then we shall have, finally,

$$\bar{A}_{X:Y}^1 = \bar{A}_{\substack{abc \dots (m) : xyz \dots (n)}}^1 \frac{1}{\dots} = \Sigma [C_{k, l} \times W_{k, l}] \quad \dots \quad [A]$$

where  $k$  and  $l$  vary independently, and the summation embraces all values of  $k$  from  $r$  to  $m$ , and all values of  $l$  from  $s$  to  $n$ , all inclusive.



If the status Y be  $\frac{[s]}{xyz\dots}$  instead of  $\frac{s}{xyz\dots}$ , the whole of the steps of the preceding demonstration will apply, except that for expression (1) we must substitute

$$\frac{Z^s}{(1+Z)^{s+1}} = Z^s - \overline{s+1}Z^{s+1} + \dots \pm \frac{l}{s \overline{l-s}} Z^l \mp \dots \quad (1^a)$$

[see *Text-Book*, Chapter II, formula (15)]. Accordingly, instead of (3) we shall have, in this case, the expression

$$-v^t \left[ \frac{Z^s}{(1+Z)^{s+1}} \cdot \frac{\Omega^r}{(1+\Omega)^r} \right] \dots \dots \dots (3^a)$$

Thus we have obtained a solution in terms of the form  $\overline{A}_{abc\dots(k):xyz\dots(l)}^1$ , which is equal to the sum of  $k$  terms of the type  $\overline{A}_{abc\dots(k):xyz\dots(l)}^1$ ; for example,  $\overline{A}_{abc:xy}^1 = \overline{A}_{abctxy}^1 + \overline{A}_{abcxy}^1 + \overline{A}_{abctxy}^1$ , and so on. For numerical calculation it will generally be better to leave the result in its original form, since  $\overline{A}_{abc\dots xyz\dots}^1$  is as easily found as  $\overline{A}_{abc\dots xyz}^1$ .

In practice, the solution may be obtained either by the direct use of formula (A), or by forming expression (3) or (3<sup>a</sup>) for the particular values of  $m, n, r, s$ , then multiplying out, and interpreting each term (as shown above) by substituting  $W_{k,l}$  for  $\Omega^k Z^l$ . The latter plan will usually be the more convenient.

First, let us take a comparatively simple example, involving only four lives, namely,  $\overline{A}_{ab:xy}^1$ . Here,  $m=n=2, r=s=1$ , and we have to expand the expression

$$\left[ \frac{Z}{1+Z} \right] \left[ \frac{\Omega}{1+\Omega} \right] = [Z - Z^2] [\Omega - \Omega^2] \\ = \Omega Z - \Omega Z^2 - \Omega^2 Z + \Omega^2 Z^2$$

for which we must substitute

$$W_{1,1} - W_{1,2} - W_{2,1} + W_{2,2}$$

$$\begin{aligned} W_{1,1} &= \overline{A}_{ax}^1 + \overline{A}_{bx}^1 + \overline{A}_{ay}^1 + \overline{A}_{by}^1 \\ -W_{1,2} &= -\overline{A}_{axy}^1 - \overline{A}_{bxy}^1 \\ -W_{2,1} &= -\overline{A}_{abx}^1 - \overline{A}_{aby}^1 \\ W_{2,2} &= \overline{A}_{abxy}^1 \end{aligned}$$

---


$$\Sigma = \overline{A}_{ab:xy}^1$$

For a more complicated example, take  $\bar{A}_{abc:xy}^{1\ 2}$ : here we must put  $m=3$ ,  $n=2$ ,  $r=2$ ,  $s=1$ , giving the expression

$$\left[ \frac{\Omega^2}{(1+\Omega)^2} \cdot \frac{Z}{1+Z} \right] = [\Omega^2 - 2\Omega^3] [Z - Z^2] \\ = \Omega^2 Z - \Omega^2 Z^2 - 2\Omega^3 Z + 2\Omega^3 Z^2$$

for which we must substitute

$$W_{2,1} - W_{2,2} - 2W_{3,1} + 2W_{3,2}$$

---


$$W_{2,1} = \bar{A}_{ab:x}^1 + \bar{A}_{ac:x}^1 + \bar{A}_{bc:x}^1 + \bar{A}_{ab:y}^1 + \bar{A}_{ac:y}^1 + \bar{A}_{bc:y}^1 \\ - W_{2,2} = -\bar{A}_{ab:xy}^1 - \bar{A}_{ac:xy}^1 - \bar{A}_{bc:xy}^1 \\ - 2W_{3,1} = -2\bar{A}_{abc:x}^1 - 2\bar{A}_{abc:y}^1 \\ + 2W_{3,2} = 2\bar{A}_{abc:xy}^1$$


---

$$\Sigma = \bar{A}_{abc:xy}^{1\ 2}$$

It will be observed in these examples that the algebraical sum of the coefficients in the result (each taken with its proper sign) is equal to +1, and it may be shown that this will always be the case when Y is of the form  $\overline{xyz \dots (n)}^s$ . If Y be of the alternative form  $\overline{xyz \dots (n)}^{[s]}$ , the sum will be zero if  $s$  be  $< n$ , but +1 if  $s$  be  $= n$ .

If in the result we expand each term of the type  $\bar{A}_{ab \dots xy}^1$  in terms of the type  $\bar{A}_{ab \dots xy}^1$  (as indicated above), it may be shown that, whichever form Y takes, the sum of the coefficients will be zero, except in the one particular case when  $s$  is  $= n$ , and  $r$  (in the status X) is  $= m$ , in which case the sum will be  $+m$ . These relations may usefully be employed to test the accuracy of the work.

In theory the method is capable of indefinite extension. For example, if we have  $\bar{A}_{abc:xw:yz}^{1\ 2}$ , the expression to be expanded will be  $[\Omega^2 - 2\Omega^3][Z - Z^2][Z' - Z'^2]$ , where Z relates to  $\overline{xw}$ , and  $Z'$  to  $\overline{yz}$ . In the interpretation of the result, a term of the form  $\Omega^2 Z Z'^2$ , for example, will give all possible assurance-values of the form  $\bar{A}_{ab:x:yz}^1$ , and so on. The result would evidently be excessively complicated, but this is inherent in the problem, by reason of the number of lives involved: it will be found that, even in the most complex cases, the application of the method is

quite simple and involves very little work. Of course, the actual evaluation of the final result would necessitate a prohibitive amount of arithmetical labour, and in practice some approximation would have to be adopted.

Finally, it may be remarked that (as may readily be seen from the nature of the process) the general result obtained for  $\bar{A}_X^1:Y$  applies equally to  $A_X^1:Y$ ; while  $tp_{XY}$ ,  $a_{XY}$ ,  $\bar{a}_{XY}$ ,  $\bar{A}_{XY}$ ,  $\bar{A}_{XY}$ , and other similar functions may be expanded by a strictly analogous process, provided that suitable modifications be given to the interpretation of  $W_k, i$ .

## REVIEW.

### *The New Mortality Experience.\**

Since our notice of the *New Annuity Experience* last January (*J.I.A.*, xxxv, 147), the Joint Committee of the Institute and the Faculty of Actuaries have published three further sections of their Report, which contain between them the Unadjusted Data of the Assurances. One volume is devoted to the Whole-Life Assurances, Males; another to the Whole-Life Assurances, Females; and the third to the Endowment Assurances and Minor Classes of Assurance. These include all the Unadjusted Data which are to be published, and there remain still to come only the Graduated Results and the Monetary Tables, with a complete account of the method of procedure, &c., adopted in the enquiry.

In the three volumes before us the headings of the various Tables are sufficiently clear to afford a full description of their contents. We need not, therefore, give any further account of these Tables, but will merely call attention to a few points that seem of special interest.

Taking first the Endowment Assurances, it appears that the Assurances on Female Lives formed but a small proportion of the total, and contributed only 42,646 years of risk and 304 deaths, as compared with 897,673 years of risk and 6,021 deaths from the Male Lives. Select Tables have been prepared, therefore, for the Male Lives only. Again, the data for participating and for non-participating assurances have been throughout combined. This is at first a little surprising, especially as the non-participating assurances contributed nearly a quarter of a million years of risk

\* *Combined Experience of Assured Lives* (1863-1893), 3 vols., collected and arranged by the Institute of Actuaries and the Faculty of Actuaries in Scotland. London: C. & E. Layton, 56 Farringdon Street, E.C. 1900.

to the Experience, and it is one of the objects of the present investigation to ascertain whether the prevailing impression that the rate of mortality among participating assurances is less than among non-participating assurances is, or is not, well-founded. No doubt, however, the Committee have satisfied themselves by a preliminary experiment that, in the case of the Endowment Assurances, the combination of the two classes would show the truer results, and this seems, in fact, most probable when one recollects that, until recent years, many of the offices which have contributed their experience did not grant participating Endowment Assurances at all. Among the Select Tables for the Male Lives, one of a somewhat novel character is introduced. This is a Table of Distribution of Withdrawals within the Year of Assurance Current at Exit, and it shows that only about 52 per-cent of the withdrawals take place in the first two months of the year—a fact which would appear to indicate that the proportion of assurances effected at half-yearly or quarterly premiums is larger than was generally supposed. In the Aggregate Tables we notice that, as in the case of the Annuities, an attempt has been made to show the effects of excluding the first *ten* years of risk from the Experience.

Turning to the Minor Classes of Assurance we find the Experience of Whole-Life Assurances with Limited Premiums, Whole-Life Assurances with Ascending Scale of Premiums, Joint-Life Assurances, Contingent-Survivorship Assurances, and Temporary Assurances. In most cases Tables have been prepared for Male Lives only, the Female Lives having contributed only a small proportion of the Experience.

Taking the Whole-Life Assurances, Males, we find among the introductory matter a most interesting Table showing the relative distribution of the present Experience and of the  $H^M$  Experience. In the  $H^M$  Experience over 87 per-cent of the Exposed to Risk occurred between ages 20 and 60; of the New Experience less than 81 per-cent is contributed by the same ages. Of the “died” the proportion between those ages in the  $H^M$  Experience was over 62 per-cent, in the New Experience it is under 47 per-cent. But perhaps the most important point is that the rate of mortality in every group of ages except 70–79 is distinctly less in the New Experience than in the  $H^M$ . It is of course to be remembered that the rates as given are unadjusted and deduced from an Aggregate Table, but even so they are reassuring, and they encourage the hope that “profit on mortality” may to some extent compensate for the diminution of other sources of profit in modern Life Assurance business. A comparison of the same kind is made between the  $H^F$  Table and the New Experience of Whole-Life Assurances, Females, and this yields results corresponding closely to those indicated above for the Males. On the whole, the rates of mortality in the New Experience are distinctly lower than in the  $H^F$  Table.

In the Whole-Life Assurances the data in respect of Participating and Non-Participating Policies have been throughout separately tabulated. That there is a very good reason for this separation may be easily judged from the following Table:—

Age	UNADJUSTED RATE OF MORTALITY IN THE FIRST YEAR OF ASSURANCE (MALES)	
	With Profits	Without Profits
20	·00295	·01155
25	·00245	·00283
30	·00312	·00408
35	·00399	·00377
40	·00468	·00307
45	·00561	·01091
50	·00944	·01206
55	·00689	·01821
60	·01855	·02370

These rates do not run at all regularly, but they are sufficient to show that on the whole the rate of mortality is higher in the Non-Participating Assurances, and this is confirmed by the figures in the Summary of Data, which show in the full Aggregate Tables :—

WITH PARTICIPATION IN PROFITS			WITHOUT PARTICIPATION IN PROFITS		
Years of Risk	Died	Rate of Mortality per-cent	Years of Risk	Died	Rate of Mortality per-cent
Males, 7,056,863	140,889	1·996	602,591	16,446	2·729
Females, 507,042	14,153	2·791	112,010	3,757	3·354

Why this should be the case it is difficult to say, but the fact remains that, in spite of the most rigid medical examination, non-profit business shows a comparatively heavy mortality. The average sum assured by the non-participating policies is probably greater than by the participating, for as a rule the insurances effected in connection with very large loan transactions are without profits. Moreover, the bulk of the Re-assurance Business interchanged by the offices is non-participating. If, then, the non-profit policies insure large amounts and show a high mortality experience, it would appear that on the whole they cannot be very remunerative to the offices. In fact, under modern competitive conditions, when the heavy initial expenses and commission are provided for, and a 3 per-cent, or even  $2\frac{1}{2}$  per-cent, net premium Reserve made for new as well as for old policies, it is difficult for the non-participating class to pay its own way, so to speak, and if the mortality experience is heavy its funds may require to be supplemented from the With-Profit class unless there is a considerable gain on Issue and Miscellaneous Policies. However, this is not a subject which calls for discussion here at the present time.

Another interesting comparison is that between the Rates of Mortality for Whole-Life Assurances and for Endowment Assurances, taking, of course, for the former the results obtained by combining the



With- and Without-Profit Assurances, Males. The unadjusted rates of mortality for the first year of assurance are as follows:—

Age	Whole-Life	Endowment Assurances
20	·00355	·00092
25	·00248	·00233
30	·00317	·00218
35	·00398	·00265
40	·00453	·00527
45	·00614	·00612
50	·00976	·00732

Except at age 40, the rates for Endowment Assurances are seen to be lower than for Whole-Life Assurances, and a glance at the results for adjacent ages shows that the figure ·00527 is too high and will be reduced when the rates are graduated. Without the adjusted rates it is difficult to draw any definite conclusion, but, on the whole, it seems probable that the selection exercised by the assured is as important as that of the medical examination; that, generally speaking, the persons who elect to pay the higher rate of premium for an Endowment Assurance are better lives than those who prefer a Whole-Life Policy.

One further question, that of the Female Extra, has some light thrown on it by the new Tables. On the whole, Dr. Sprague's conclusions (*J.I.A.*, xxxi, 228), are confirmed; and it seems clear that up to age 45 at any rate, an extra should be required for Female Lives.

Leaving the rate of mortality, the most important question that suggests itself is what effect the New Experience is likely to produce on Reserves. To deal with this adequately is impossible without the complete Monetary Tables that are being prepared; but some indication may be afforded by a comparison of the values of the

ratios  $\frac{e_x - e_{x+n}}{1 + e_x}$  in the  $H^M$  Table and in the New Experience. The following Table has been prepared by taking the "expectations" from the Aggregate Table for Combined Old and New Assurances (Whole-Life Assurances, Males). The values from the Participating and Non-Participating data are given separately.

It will be seen that on the whole the figures for the  $H^M$  Table are the lowest, for commencing ages 20, 30, and 40. As considerably more than half the entrants in a modern Life Office are below age 40, it seems very probable that a change in the Valuation Table from the  $H^M$  to the New Experience may involve a large addition to the Reserve with a corresponding diminution of the amount immediately available for distribution. To many offices this may prove rather a serious matter, especially as recent events have tended on the whole to impair the ordinary sources of profit of Life Assurance business. The measure of the change can only be determined when the Monetary Tables based on the New Experience are available, and it is to be hoped, therefore, that the Committee will do all in their power to hasten the publication of these Tables.

$x$	$n$	Value of $100 \frac{(e_x - e_{x+n})}{1 + e_x}$		
		HM Table	New Experience	
			With Profits	Without Profits
20	5	8.590	9.235	8.451
	10	17.339	18.379	17.559
	20	34.448	35.808	35.141
	30	51.113	52.196	51.502
30	5	10.417	10.843	10.820
	10	20.699	21.353	21.327
	20	40.860	41.431	41.173
	30	59.268	59.567	59.425
40	5	12.929	12.941	12.704
	10	25.424	25.529	25.226
	20	48.636	48.590	48.426
	30	67.759	67.560	67.680
50	5	16.072	16.004	15.973
	10	31.126	30.966	31.026
	20	56.767	56.439	56.776
	30	74.916	74.621	75.024

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## THE INSTITUTE OF ACTUARIES.

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### BROWN PRIZES, 1899.

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The Syllabus of the Brown Prizes, 1899, is given in vol. xxxiv, page 594. The President, Mr. C. D. Higham, at the opening meeting of the session on 26 November last, announced the result of the competition. He said that the adjudicators had awarded the first prize to Mr. John Nicoll, A.I.A., F.F.A., who, two years ago, won one of Mr. Chisholm's prizes for his thesis on "The Relation of the Actuarial Profession to the State."

The second prize was not awarded, as no one of the efforts of the other three competitors, though worthy of much commendation, was considered to be of sufficient merit.

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## LECTURES.

PREVIOUS Courses of Lectures having proved so acceptable to the Members, the Council have arranged for a further Course, on the Law of Mortgage, as follows:

SYLLABUS of a Course of Six Lectures, by MR. W. G. HAYTER,  
*Barrister-at-Law, on "The Law of Mortgage,"*

TO BE DELIVERED BEFORE THE MEMBERS OF THE INSTITUTE

ON MONDAY,	21 JANUARY,	1901, at 5.30 P.M.
„	4 and 18 FEBRUARY,	1901, „
„	4 „ 18 MARCH,	1901, „
„	1 APRIL,	1901, „

## I.

Definition of Mortgage—The old Mortgage in law—Principles introduced by the Equitable Jurisdiction of the Court of Chancery—The Equity of Redemption—"Once a Mortgage always a Mortgage"—Form of a modern Mortgage-deed—The Right of the Mortgagor to redeem—The Right of the Mortgagee to foreclose—Definition of Equitable Mortgage—The two classes of Equitable Mortgage distinguished.

## II.

Mortgages of Copyholds—Mortgages of Leaseholds, should be by Demise—Conveyancing Act, 1892—Mortgages of Choses in action—Judicature Act, 1873—Mortgages of (a) Policies of Insurance (b) sums of stock or shares (c) Reversionary interests in trust funds—Clause for Conversion of interest in arrear into principal—Choses in Action only assignable subject to prior equities—Necessity of Notice—Stop Order and Distringas—Mortgages of Personal Chattels—The Bills of Sale Acts.

## III.

Contributory Mortgages—Mortgages for a fixed term—Dealings with the Equity of Redemption—The Doctrine of Tacking—The Doctrine of Consolidation—Danger of taking second Mortgages—Priorities as between Mortgagees—Explanation of Maxims "Where Equities are equal the law will prevail" and "Qui prior est tempore potior est jure"—Notice of prior charge—The possession of the title-deeds of Mortgaged property.

## IV.

Powers of a Mortgagor in possession—Position of a Mortgagee in possession—Effect of the Statutes of Limitations—The Mortgagor's Action for Redemption—His right to demand a Sale in an Action for Redemption or Foreclosure—The Mortgagee's right to six months' notice of payment off—Transfer of Mortgages—Why the Mortgagor

should be joined—Re-conveyance of Mortgage—Section 15 of the Conveyancing Act, 1881.

## V.

The Rights and Remedies of the Mortgagee—The Action for Foreclosure—Rights under the Conveyancing Act, 1881, (*a*) To sell, convey, and give a good discharge for the purchase-money; (*b*) To insure and add the premiums to his security; (*c*) To appoint a receiver of the mortgaged property—Right of the Mortgagee to pursue all his remedies at once—Bankruptcy of the Mortgagor—The Mortgagee's Action on the Covenant—Title to Policies of Insurance on the life of the Mortgagor.

## VI.

Effect of the Land Transfer Acts, 1875 and 1897, on Mortgages of Land—Creation of Mortgages and Charges of registered land—How such Mortgages and Charges are dealt with when created—How the Mortgagee of registered land enforces his security—How the Charge can be put an end to—Position of incumbrancers under incumbrances made prior to the first registration of land.

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DECEASED FELLOWS OF THE INSTITUTE.

In suitable terms, the President, at the meeting on 26 November, referred to the losses by death sustained by the Institute since the annual meeting in June.

In July there was announced the death of Mr. Henry William Porter, at a ripe old age. He had been Vice-President, and a frequent contributor to the *Journal* on a variety of subjects; and he had always been forward to promote the interests of the Institute.

In September, Mr. Alexander John Finlaison, C.B., was removed at a comparatively early age, and condolence at his loss had been expressed by various actuarial bodies on the Continent. Almost by heredity, he occupied an important position in the State, and, after filling various offices in the Institute, he was—again, as it were, by heredity—elected to the Presidential chair in 1894 and 1895.

Quite recently the name of Mr. George Cutcliffe had to be removed from the roll. Through his retirement in 1882 to his Devonshire home, some of the younger members might not have been aware of his services as Treasurer and as Vice-President, but to those who knew him, though out of sight, he was not out of mind.

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NEW MEMBER OF COUNCIL.

At the meeting on 26 November, the President announced that, to fill the vacancy caused by the death of Mr. Finlaison, the Council, acting under the powers conferred upon them by the Charter and Bye-Laws, had elected as member of the Council Mr. George Macritchie Low, President of the Faculty of Actuaries in Scotland.

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